Program for Mass Transportation

P M T

Produced by the Central Transportation Planning Staff for the Massachusetts Bay Transportation Authority

PROGRAM FOR MASS TRANSPORTATION

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EXECUTIVE SUMMARY

The Program for Mass Transportation (PMT) is a central element of capital planning at the Massachusetts Bay Transportation Authority (MBTA) and is the foundation for transit infrastructure planning and programming in eastern Massachusetts. The PMT defines a vision for regional mass transportation and sets priorities for infrastructure investments in the areas of system preservation, service enhancement, and system expansion, without financial constraints.

BACKGROUND

The MBTA is the largest transit provider in the Massachusetts Bay region. It directly operates or contracts out for service using eight different modes: heavy rail, light rail, bus rapid transit, local/express bus, trackless trolley, commuter rail, commuter boat, and paratransit. The MBTA system serves the area in a largely hub-and-spoke network. In Boston, 55% of all work trips and 42% of all trips into downtown are made by transit. In the Boston Metropolitan Planning Organization region overall, 6.8% of all trips are made by transit, and it is estimated that that number will increase to 7.47% by 2025.

The MBTA district is made up of 175 communities with a total population of 4.7 million. Almost three-quarters of all Massachusetts residents live within the MBTA service area. The MBTA transit system was originally designed to move people efficiently into and around fourteen communities in the urban core, but is now called on to supply multimodal travel options for residents of eastern Massachusetts and parts of central Massachusetts. Regional population grew at a moderate rate of 6.07% during the 1990s, but significant growth of over 25% took place along the Route 495 corridor. (It should be noted though that the city of Boston experienced a rebound in population growth in the 1990s after several decades of decline.)

The Boston region is one of the most economically vibrant areas in the country. The number of jobs in the region has increased by 44% over the last thirty years. In the last decade, the MBTA district experienced job growth of 12.6%. Economic growth is most pronounced in the Route 495 corridor, where the job base expanded at rates more than three times the region's average.

Together, these demographic changes have impacted commuting trends within eastern Massachusetts and have strained the overall

transportation system. In particular, traffic congestion on most of the major highways in the region has increased significantly during the past twenty-five years. The corridors served by most of the radial highways that are close to or over practical capacity are also served by MBTA commuter rail or rapid transit lines. Transit can provide some solutions to this mobility problem; however, transit alternatives for the circumferential Route 128 and Route 495 corridors present great challenges.

Forecasts estimate that overall MBTA ridership will grow by 32% between now and 2025. MBTA commuter rail ridership is predicted to increase by 45% during the same period. The current capacity constraints of the MBTA system, if not addressed, would limit the Authority's ability to improve regional mobility and meet future demand for public transit.

Anderson Regional Transportation Center

Capacity issues exist both on vehicles and at MBTA facilities. Numerous bus routes in the urban core exceed MBTA Service Delivery Policy guidelines for maximum loads, especially during peak periods and school commute times. Each of the MBTA's rapid transit lines also experiences loads exceeding Service Delivery Policy guidelines on multiple trips, and peak 30-minute average maximum loads exceed 80% of practical capacity on all four lines.

Over the next twenty-five years, rail and boat terminals, as well as station access facilities such as parking lots and pedestrian walkways, and maintenance facilities must be expanded to address growing demand for transit service. In particular, the predicted growth in commuter rail ridership suggests that capacity problems will be significant over that period.

Furthermore, the commuter rail system is limited by the capacities of the downtown Boston terminal stations and layover facilities.

Overall, the changing demographics of the region indicate the need for more transportation options in eastern Massachusetts. For the MBTA to play its role in providing greater mobility for residents, capacity-building projects need to be prioritized to address the limitations of the existing transit system.

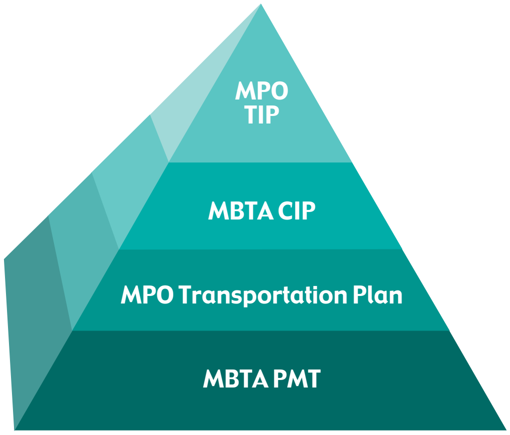
DEVELOPMENT OF THE PMT

This PMT is the first to be completed since the restatement of the MBTA's enabling legislation in 1999. In that year, Governor Paul Cellucci signed into law a major initiative, "Forward Funding," that altered the MBTA's financial structure and expanded the MBTA's service area from 78 municipalities to the current 175. Several changes were also included in "Forward Funding" that strengthen the MBTA's capital planning process. For example, the MBTA will complete an updated PMT every five years. "Forward Funding" also called for the institution of annual Capital Investment Programs (CIPs). These are rolling five-year documents that program specific projects for implementation and identify funding sources.

The PMT has a timeframe of twenty-five years and incorporates a financially unconstrained, consistent evaluation of project ideas. Projects included in the PMT then define the universe of projects for all subsequent stages of regional transit planning conducted by the MBTA and other decision-making bodies such as metropolitan planning organizations (MPOs).

The relationship between the PMT and other

regional planning documents is depicted in the diagram below.



The PMT prioritizes infrastructure investments in the areas of system preservation, service enhancement, and system expansion, and must balance the demand for expanded service with the need to reinvest in the existing system. By establishing a universe of potential transit capital projects, the PMT helps to design a strategy for public transportation investments over the next twenty-five years.

Work on this PMT began in the spring of 2001. The process involved extensive outreach to the general public, detailed consultation with a public advisory committee, technical analysis and evaluation, and policy-level reviews.

There were five main steps in producing the PMT:

1. Development of a Vision Statement, Goals, and Objectives

Through an extensive public process, a vision statement was developed to describe the role of transit in eastern Massachusetts's transportation network in twenty-five years. Goals and objectives were established to outline the strategy for implementing this vision.

2. Project Screening

Extensive public outreach generated hundreds of project ideas for all modes – eight public workshops were held in the fall of 2001 throughout the service area. These ideas were included in the universe of projects evaluated in the PMT. The MBTA and the PMT process Working Committee reduced the universe to a shorter list of feasible projects that warranted further evaluation. Consistent criteria were defined for use in conducting this screening process. These criteria included, but were not limited to, considerations of whether a project met an existing legal commitment or addressed an environmental justice issue.

3. Project Evaluation

The projects that emerged from the screening phase were evaluated using performance measures to determine how well they met PMT goals and objectives. Performance measures were developed for the following three investment categories:

System Expansion

Projects that introduce service to an area or time period in which it currently does not exist, or convert an existing service to a new mode.

Service Enhancements

Projects that improve the quality of service provided on an existing transit line or at an existing station. These were organized into general enhancements, accessibility (for people with disabilities) projects, and sta-

The RIDE operator and customer

tion access projects.

System Preservation

Projects aimed at keeping the MBTA's system in a state of optimal repair.

The project ideas were further divided by mode type: commuter rail, rapid transit, bus/trackless

MBTA bus crossing the Tobin Bridge

trolley, boat, and other modes. Projects were then evaluated within each mode.

System expansion and general service enhancement projects were evaluated based on thirty-five individual performance measures divided into the following seven categories:

- Utilization
- Mobility
- Cost-Effectiveness
- Air Quality
- Service Quality
- Economic and Land Use Impacts (not applied to general service enhancement projects)
- Environmental Justice

For each performance measure that was applicable to a given project, a high, medium, or low rating was assigned. In the case of quantitative measures, the thresholds for high, medium, and low ratings were defined by first listing the corresponding impacts of all projects in a given grouping in order of magnitude. Natural breaks, or large gaps between the impacts of successive projects in the list, were identified and the first grouping was given a high rating. The second and third groupings were given medium and low ratings, respectively. For qualitative measures, the thresholds for high, medium, and low ratings were defined before their application to specific projects.

The ratings for each performance measure category were then combined to define an overall rating for each project. Lists of projects rated high, medium, and low overall begin on page ES-6 of this summary.

4. Review of draft PMT

Four workshops around the MBTA service area were held in January 2003 to gather input from the public on the evaluation process and preliminary results. On February 12, 2003, the MBTA released the PMT for a thirty-day public review period. Two public hearings were then held in March on the draft PMT.

5. Finalization of PMT

All comments received during public review were considered, and where appropriate, were incorporated into the PMT. This draft was reviewed and approved by the MBTA board of directors. Final acceptance of the PMT rests with the MBTA Advisory Board, which approved this PMT on May 29, 2003.

VISION AND GOALS

As described above, the first step of the PMT process was to develop the following twenty-five-year vision for public transportation in the Massachusetts Bay region.

The MBTA will:

- Provide safe, cost-effective, and efficient services that increase ridership and respond

to the expanding mobility demands of individuals and communities.

- Maintain existing infrastructure in a state of optimal repair to improve quality, convenience, accessibility, and reliability of service.
- Transport customers in a system that promotes a desirable quality of life, supports the sustainable development of communities, improves the quality of the environment throughout the Massachusetts Bay region, and distributes benefits and burdens equitably.

This vision will be implemented through the following goals.

The MBTA will strive to:

- Preserve and modernize the transit system and improve accessibility.
- Improve mobility for area residents and visitors now and in the foreseeable future.
- Minimize transportation-related pollution of the environment.
- Promote the equitable sharing of the transportation system's benefits and burdens.
- Serve as a partner for community development within the MBTA service area.

IMPLEMENTATION OF GOALS

As one of the country's oldest transit systems, the MBTA is faced with an enormous backlog of system preservation needs. Currently, this backlog is estimated at $3.0 billion, with $13 billion in additional needs forecast over the next twenty years. A central element of this PMT is the MBTA's reinvestment in the existing system to improve service to our customers. To meet the PMT's identified goals, the MBTA's investment strategy is to:

- Address the backlog of system preservation needs.
- Reinvent the MBTA bus system.
- Improve environmental performance of facilities and operations.
- Relieve system capacity constraints.
- Strive for a balanced capital program that is responsive to urban core mobility needs and suburban demand for transit choices.

Based on this investment strategy and the individual project ratings included in the PMT, the following projects have been identified as the highest priority for implementation, and the MBTA is currently exploring options for securing their funding:

System Expansion

- Silver Line Phase III: South Station–Boylston Station connector
- Urban Ring: new circumferential transit services
- Fairmount Line improvements: additional stations and improved frequency

Blue Line at Wonderland Station

- Blue Line extension from Wonderland to Lynn

Service Enhancements

- Expanded reverse-commuting options systemwide

- 300 new bus shelters
- Signal improvements on Blue, Orange, and Red Lines
- Installation of Intelligent Transportation Systems

System Preservation

- Installation of automated fare collection system
- Revenue vehicle replacement
- Bridge rehabilitation
- Commuter rail and rapid transit track replacement
- Station improvements

In addition to these projects, the PMT provides a sense of relative priorities for all system expansion, service enhancement, and system preservation projects that passed the project screening phase. These proposed projects are located throughout the Massachusetts Bay region and may be considered for inclusion in regional capital programming documents when funding becomes available. Projects that receive a high rating in the PMT offer a good starting point for an expanded and improved public transportation system in twenty-five years. It should, however, be noted that the classification of a project as having a high rating does not guarantee its implementation.

Silver Line

In the interests of meeting the diverse mobility needs of the region, avoiding duplicative projects, and responding to fiscal realities, medium-priority projects will also be given due consideration for implementation. Even low-priority projects are eligible for advancement in other regional capital programming documents, especially in cases where future residential and employment development results in increases in projected demand or where outside funding sources are identified. An example of such a project is the proposed Commonwealth Flats Silver Line grade separation in the South Boston Waterfront area.

Below are listings of system expansion and general service enhancement projects receiving high, medium, and low ratings. Maps ES-1 and ES-2 show the locations of projects in the high rating list. Maps ES-3 and ES-4 show high priority accessibility and parking improvement projects. Details on medium- and low-priority accessibility projects are given in Chapter 5B.

HIGH PRIORITY

System Expansion Projects

Rapid Transit

Blue Line: Wonderland to Lynn

Silver Line Phase III: South Station to Boylston via Chinatown

Silver Line south extension to Ashmont and Mattapan

Urban Ring Phase 2

Urban Ring Phase 3

Bus/Trackless Trolley

Improve suburban feeder bus service to commuter rail

Urban Ring Phase 1

Commuter Rail

New station on Fitchburg Line at Union

Square, Somerville

Improve Fairmount Line: new stations and improve frequency

Extend line from Stoughton to Fall River and New Bedford

Construct North-South Rail Link (multistate project)

Commuter rail branch from existing Old Colony lines to Greenbush

Boat

New service to Russia Wharf

Service Enhancement Projects

Rapid Transit

Signal improvements on Blue Line

Signal improvements on Orange Line

Signal improvements on Red Line

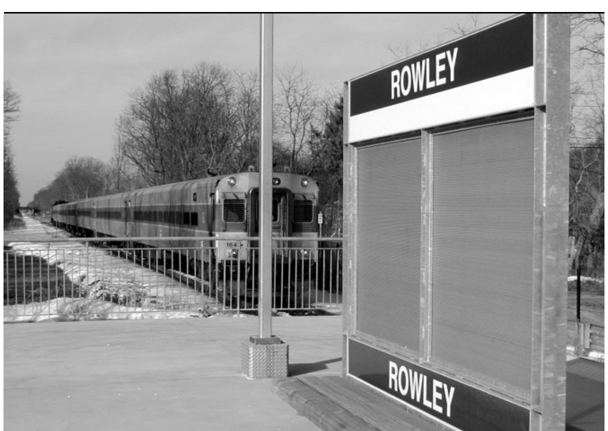
Bus/Trackless Trolley

Install 300 shelters

Install Intelligent Transportation Systems

Commuter Rail

Operate a Yawkey–Back Bay–South Station shuttle



Rowley commuter rail station

Operate more frequent service between Framingham and Worcester

Expand reverse-commuting options

Systemwide

Improve pedestrian access to all rapid transit and commuter rail stations

MEDIUM PRIORITY

System Expansion Projects

Rapid Transit

Blue Line: Bowdoin to West Medford

Blue Line: Lynn to Salem

Blue-Red Connector: Bowdoin to Charles/MGH

Green Line: Heath Street to Arborway

Green Line: Lechmere to West Medford

Silver Line west extension: Boylston to Allston and Longwood

Silver Line east extension: South Station to City Point

Bus/Trackless Trolley

Provide dedicated bus lanes approaching Alewife Station

Commuter Rail

Improve Fitchburg Line by adding a station at Alewife

Extend line from Fitchburg to Gardner

Improve Framingham/Worcester Line: new station in Allston/Brighton

Operate high-frequency service: Readville to Allston Landing

Improve Worcester Line: new station in Millbury

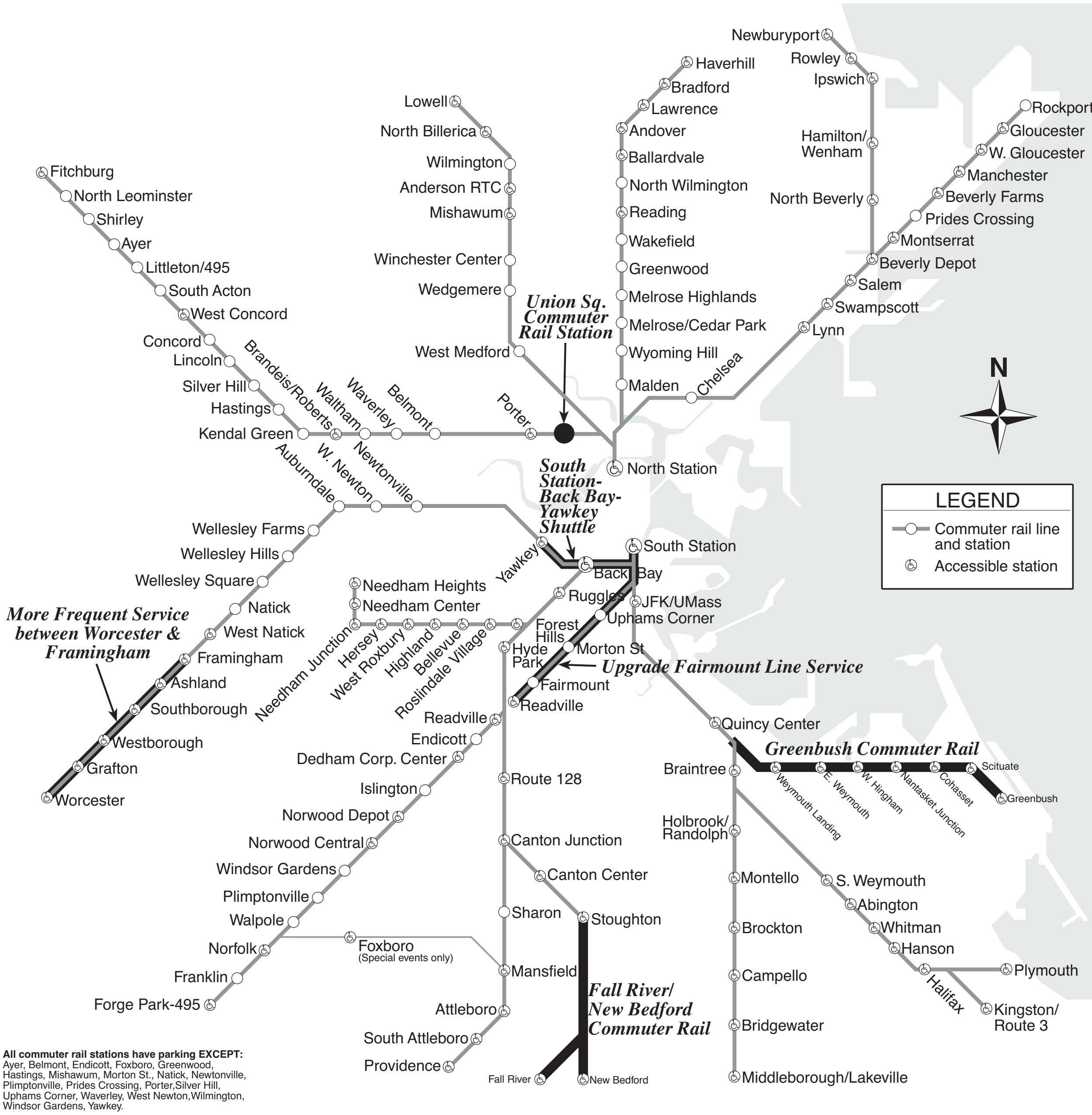
Improve Framingham/Worcester Line: new sta-

MAP ES-1 HIGH-PRIORITY SYSTEM EXPANSION AND SERVICE ENHANCEMENT PROJECTS: RAPID TRANSIT, BUS, TRACKLESS TROLLEY, AND BOAT

High-priority projects not labeled on map:

- Improve suburban commuter rail feeder bus service
- Signal improvements on Blue, Orange, and Red Lines
- Install 300 bus shelters
- Install Intelligent Transportation Systems
- Improve pedestrian access to all rapid transit and commuter rail stations

MAP ES-2 HIGH-PRIORITY SYSTEM EXPANSION AND SERVICE ENHANCEMENT PROJECTS: COMMUTER RAIL (EXCLUDES MULTISTATE EXPANSION PROJECTS)

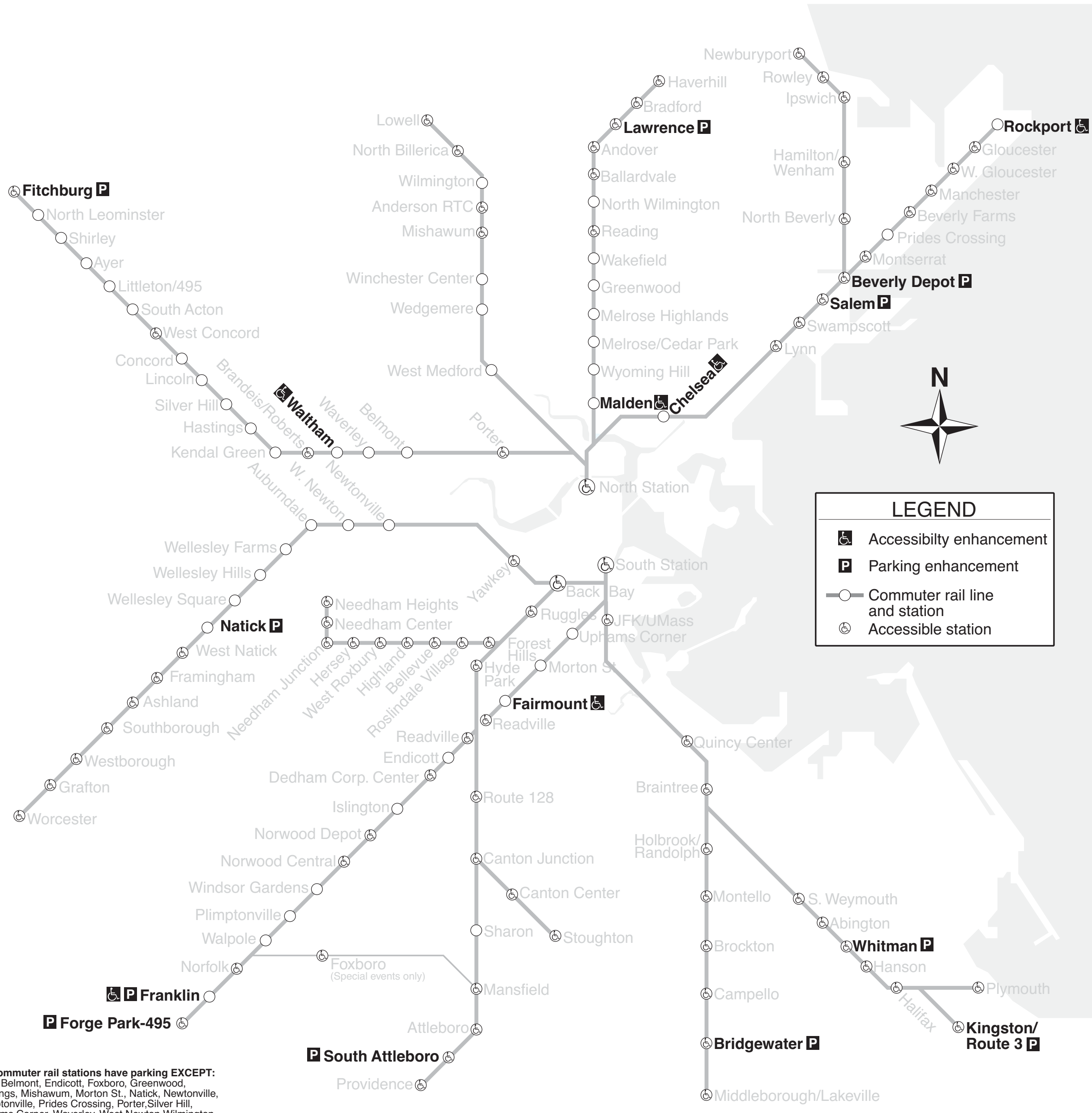


High-priority projects not labeled on map:

- Expand reverse-commuting options
- Improve pedestrian access to all rapid transit and commuter rail stations
- Note: The North-South Rail Link also received a high-priority designation in the PMT but is not shown on this diagram since it is classified as a multistate expansion project.

MAP ES-3 HIGH-PRIORITY RAPID TRANSIT ACCESSIBILITY AND PARKING ENHANCEMENTS

MAP ES-4 HIGH-PRIORITY COMMUTER RAIL ACCESSIBILITY AND PARKING ENHANCEMENTS



All commuter rail stations have parking EXCEPT:
Ayer, Belmont, Endicott, Foxboro, Greenwood, Hastings, Mishawum, Morton St., Natick, Newtonville, Plimptonville, Prides Crossing, Porter,Silver Hill, Uphams Corner, Waverley, West Newton,Wilmington, Windsor Gardens, Yawkey.

tion at Riverside

Extend line from Middleborough to Wareham

Build spur from Salem to Danvers via Peabody

Extend line from Forge Park to Milford via Bellingham

Improve Rockport/Newbury Line: new station in South Salem

Extend line from Providence to T. F. Green Airport (multistate project)

Extend line from Haverhill to Plaistow, N.H (multistate project)

Build spur from Framingham to Leominister

Extend line from Lowell to Nashua via North Chelmsford (multistate project)

Extend line from Needham to Millis via Medfield and Dover

Boat

Restore service from East Boston to Boston

Improve service from South Shore

Service Enhancements

Rapid Transit

Operate 8-car trains on Orange Line

Operate 8-car trains on Red Line

Preemptive traffic signals on Green Line B, C, and E branches

Bus/Trackless Trolley

Add bus lanes and priority signals on top 10 busiest bus routes

Acquire 100 new buses

Commuter Rail

Operate express service from outer stations

Install a fourth track on the Fort Point Channel Bridge

Install double-tracking on entire commuter rail system

Type-8 Green Line car

Systemwide

Install bike racks at rapid transit and commuter rail stations

Install more enclosed waiting areas along MBTA lines

LOW PRIORITY

System Expansion Projects

Rapid Transit

Blue Line: build commuter rail connector at Wonderland

Green Line: build spur from Eliot to Needham Junction

Orange Line: add a station at Assembly Square

Orange Line: extend from Forest Hills to Hyde Park/Route 128

Orange Line: extend from Forest Hills to West Roxbury/Needham

Orange Line: extend from Oak Grove to Reading/Route 128

Red Line: extend from Alewife to Route 128

Red Line: extend from Braintree to Weymouth

Silver Line: convert to light rail from Dudley to Boylston

Bus/Trackless Trolley

Extend trackless trolley #71 from Watertown to Newton Corner

Route 128 bus service using an HOV lane

Commuter Rail

Improve Fitchburg Line: new station on Route 2 west of I-495 in Ayer

Operate high-frequency Riverside–JFK/Umass Commuter Rail Service

Operate high frequency Riverside–South Station commuter rail service

Operate full-time service to Foxborough

Improve Framingham/Worcester Line: new regional station at I-495

Extend Line from Wareham to Hyannis

Boat

New route from North Shore to Logan Airport

Service Enhancement Projects

Rapid Transit

Commonwealth Flats Silver Line grade separation

Operate 4-car trains on Green Line

Signal improvements on Green Line

Commuter Rail

Install platforms on both sides of stations in Newton for reverse commuting

Increase speed and frequency of Needham service

Purchase DMU trains to allow for increased frequency on commuter rail lines

Electrify all commuter rail lines (excluding yards)

Build new layover facility in Bellingham for the Franklin Line

Systemwide

Add bike racks to commuter rail coaches

Add more motorcycle parking spaces systemwide

Commuter boats at Lovejoy Wharf

As an additional factor in determining priorities for implementing transit capital improvements, it should be noted that the Commonwealth has committed to several public transportation projects and initiatives to meet various state and federal mandates and obligations (these are collectively known as the "Legal Commitments"). In particular, the Commonwealth has identified improving transit as a way to address the requirements associated with the State Implementation Plan (SIP) for the Clean Air Act and the mitigation, pursuant to 310 CMR 7.36 and 310 CMR 7.38, required by environmental agencies to allow for the permitting of the Central Artery/Tunnel (CA/T) Project. In 2000, the Executive Office of Transportation and Construction (EOTC) and the Department of Environmental Protection (DEP) entered into an Administrative Consent Order (ACO) related to the CA/T Project that established additional legal commitments and clarified deadlines for

their completion. In 2001, the ACO was amended to provide further clarity for some of the Legal Commitments.

The MBTA is playing an active role in fulfilling the Legal Commitments. Although the commitments are binding on the Commonwealth, the MBTA is evaluating and prioritizing the commitments within the PMT so that these projects continue to be eligible for programming within the CIP. Table ES-1 on the following page shows the status of the Legal Commitments.

FINANCING STRATEGIES

As a financially unconstrained analysis of transit projects, the PMT includes significantly more projects than can be funded by the MBTA or the Commonwealth. The funding situation is complicated by the Commonwealth's legal commitments related to the State Implementation Plan (SIP) for the Clean Air Act and the Central Artery/Tunnel (CA/T) mitigation program. New and innovative financing sources will be needed to supplement more traditional funding in order to implement many of the projects in this PMT.

The new Enabling Act under "Forward Funding" established dedicated sources of revenue and mandated that the MBTA is to operate as an independent, financially self-sustaining public transportation agency. Prior to "Forward Funding," the Commonwealth funded the MBTA in arrears.

Beginning on July 1, 2000, the MBTA no longer received net-cost-of-service or debt assistance. Instead, under the restated Enabling Act, the MBTA receives a dedicated revenue stream consisting of assessments paid by the 175 cities and towns in accordance with the Enabling Act and a portion of the statewide sales tax. In addition to the dedicated revenues, the MBTA's operations are funded by fare and nonfare revenues. Nonfare funding can include revenues from advertising, parking, concessions, real estate sales, and interest income.

Innovative financing is an important element of project implementation. These sources can often mean the difference in a project moving forward within a region's planning process. As a project moves from the PMT into other elements of the planning process, financial constraints are increasingly introduced that force regional decisions on priorities.

Innovative sources of funding can be found at all levels of government, as well as the private sector. Some examples of innovative funding tools include tax increment financing, joint development, and project financing.

Table ES-1 Status of SIP and CA/T Projects

COMPLETED PROJECTS

Project	SIP Commitment	CA/T Commitment	ACO Commitment
Newburyport Commuter Rail Extension	Yes	Yes	No
Service to Worcester Commuter Rail Extension	Yes	Yes	No
Interim Worcester Stations	No	No	Yes
Washington Street Replacement Service	No	Yes	Yes
400 New Buses	No	Yes	No
20,000 Additional Parking Spaces	Yes	Yes	Yes
Old Colony Commuter Rail Restoration – Middleborough/Kingston	Yes	Yes	No
Bus Retrofits	No	No	Yes

PROJECTS UNDERWAY

Project	SIP Commitment	CA/T Commitment	ACO Commitment	Status
Old Colony Commuter Rail Restoration – Greenbush	Yes	Yes	Yes	Design and permitting ongoing
Red Line–Blue Line Connector	Yes	Yes	Yes	In planning stages
Blue Line Station Platform 6 Car Trains	Yes	Yes	Yes	Under construction
Green Line Extension to Tufts (Medford Hillside)	Yes	Yes	Yes	In planning stages
Green Line Arborway Restoration	Yes	Yes	Yes	In planning stages
New Orange Line Vehicles	No	Yes	No	In planning stages
South Boston Piers Transitway	Yes	Yes	Yes	Under construction
2 Commuter Boat Facilities	No	Yes	No	In planning stages
Alternative–Fuel Bus Purchases (358 CNG Buses)	No	No	Yes	Purchase orders issued
Orange Line Signal Improvements	No	No	Yes	In planning stages
Service to T. F. Green Airport	No	No	Yes	In planning stages (RIDOT)
Silver Line Phase III	No	No	Yes	

SIP: State Implementation Plan for the Clean Air Act

CA/T: Central Artery/Tunnel Project

ACO: EOTC/DEP Administrative Consent Order

CHAPTER 1

Overview of the Program for Mass Transportation Process

The Program for Mass Transportation (PMT) is a central element of capital planning at the Massachusetts Bay Transportation Authority (MBTA) and is the foundation for transit infrastructure planning and programming in eastern Massachusetts. The MBTA's original enabling legislation (now repealed) and, more recently, its replacement "Forward Funding" legislation provide direction for this long-range planning. The PMT defines a vision for regional mass transportation and sets priorities for infrastructure investments in the areas of system preservation, service enhancement, and system expansion, without being financially constrained. As the 25-year "master plan" for the MBTA, the PMT must strike a balance between service expansion and the need to reinvest in the existing system.

MBTA Enabling Legislation, "Forward Funding," and Capital Planning

Prior to its incorporation and reworking as part of "Forward Funding," the MBTA's original enabling legislation (M.G.L. Chapter 161A, Section 5g) obligated the Authority to develop a long-range capital program. The Executive Office of Transportation and Construction developed the first PMT in 1966 and adopted major revisions in 1978 and 1994.

In 1999, Governor Paul Cellucci signed into law the major initiative, "Forward Funding," that altered the MBTA's financial structure and expanded the MBTA service area from 78 communities to the current 175 cities and towns.

The Current MBTA Capital Planning Process

"Forward Funding" brought several changes that strengthen the MBTA's capital planning process. The MBTA must now complete an updated PMT every five years (the original enabling legislation did not establish a schedule for regular reviews of the PMT). "Forward Funding" also further defined the development of the Capital Investment Program (CIP). The CIP is a rolling five-year capital plan that is updated annually. The PMT and CIP work together, with the PMT defining the long-range vision for mass transportation in

eastern Massachusetts and prioritizing infrastructure investments, and the CIP serving as a tool with which the MBTA implements its priorities from the PMT.

The Massachusetts Bay Transportation Authority (MBTA) created the Capital Investment Program (CIP) to provide an understanding of the Authority's planned capital expenditures for a five-year planning horizon, as well as to outline the need for future capital investment. The program classifies similar capital efforts together into structured projects and further into programmatic areas.

The PMT's Role in Regional Planning

The MBTA interacts with a number of different planning processes in Eastern Massachusetts. The Boston Region Metropolitan Planning Organization (MPO) is comprised of 101 municipalities, all in the MBTA's service area. Due to this geographic overlap, the MBTA works closely with the MPO on transit planning. Together, the PMT and CIP directly inform the MPO's capital planning efforts, which involve the development of a Regional Transportation Plan (Plan) and the annual Transportation Improvement Program (TIP).

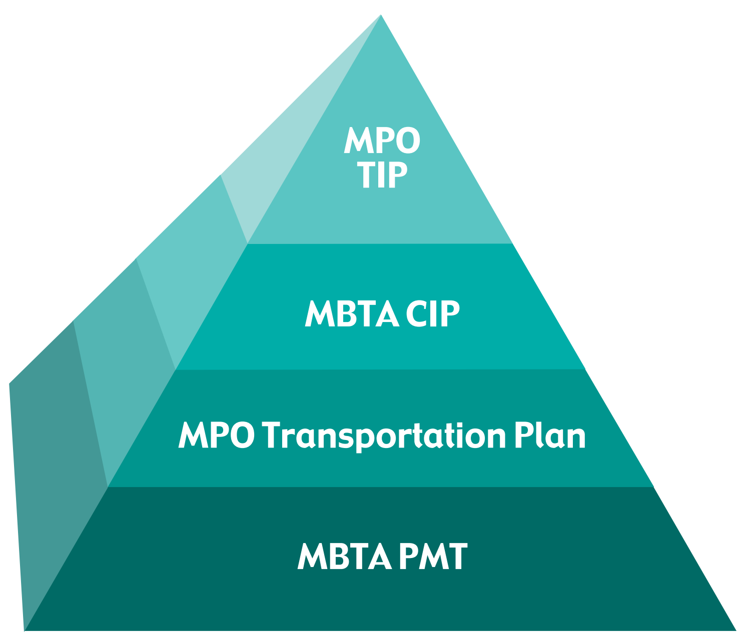
These closely coordinated MBTA and MPO processes function as a pyramid-like structure for transit planning in the Boston MPO region. As a financially unconstrained and objective analysis, the PMT establishes the project universe for all subsequent stages of planning and programming for the MPO. In deciding transit priorities within the Plan, the MPO introduces the region's financial constraints, then considers PMT projects for inclusion. For a project to move forward, it next must be programmed in the CIP. Using the projects identified in the PMT and the Plan, the MBTA develops this capital program. The CIP funds these priorities with both federal and non-federal monies. The MPO then programs the MBTA's federal projects selected from the CIP in the annual TIP.

Other MPOs with communities in the MBTA service area use the PMT in their planning processes as well. With all MPOs, the MBTA's internal framework for capital planning provides an objective tool for decision-makers to use in making intelligent choices about programming MBTA projects in their regions.

PMT – The Vision of Future Transit

By establishing the universe of projects for regional transit planning, the PMT helps to build a vision of what public transit could look like over the next twenty-five years. The fiscal challenges that face the Commonwealth and the MBTA will influence how much of this vision is implemented.

As one of the country's oldest transit authorities, the MBTA is faced with an enormous backlog in system preservation needs. Currently, this backlog is estimated at $3.0 billion, with $13 billion in additional needs forecast over the next twenty years. To meet this challenge, the MBTA has instituted a policy of



dedicating at least 70% of capital spending to system preservation projects. In order to meet or exceed this goal, the MBTA will continue to utilize the backlog of system preservation needs identified in the "universe of projects" in programming future CIPs.

In the Draft FY04 - FY08 Capital Investment Program (CIP), the MBTA has programmed $2.8 billion in capital projects. The CIP is broken down into four major programmatic areas: 1)reinvestment in the infrastructure ($1.85B); 2) accessibility improvements ($136M); 3) enhancement of existing service ($237M); and 4) system expansion efforts ($569M). These first three areas of the CIP support the Authority's commitment to reinvesting in its present system, with the most substantial share of the programmed spending ($2.2B or 80%) devoted to the maintenance (system preservation) and enhancement (system enhancement) of the existing system. It is important to note that the PMT establishes priorities within investment categories; whereas, the CIP, as the implementing process for the PMT, provides project-specific details on expenditures. Because the PMT is meant to provide information at the asset category level, it does not cite all the specific projects, which the MBTA would consider for programming in the CIP. Therefore, a central element of this PMT is the MBTA's reinvestment in the existing system to improve service to our customers.

Anderson Regional Transportation Center

This PMT also recognizes the significant transit needs within the MBTA's now expanded service district. The PMT provides a sense of relative system expansion priorities for consideration when money becomes available to the region. Ultimately, the PMT offers a vision that is responsive to urban core mobility needs and suburban demand for transit choices.

THE PMT DEVELOPMENT PROCESS

The 2003 PMT was developed during a twenty-month process which involved extensive outreach to the general public, detailed consultation with the PMT Working Committee, technical analysis and evaluation, and policy-level reviews.

Overview

Work on the 2003 PMT began in the spring of 2001 with the start of the planning process. Work included outreach, information gathering, technical analysis and evaluation, and reviews by the MBTA and Central Transportation Planning Staff. A broad outreach to the general public and major stakeholders brought in ideas and other input to guide and refine the PMT. In the spring of 2003, the process will culminate in the MBTA Board of Directors' consideration of the document. After their concurrence, the MBTA Advisory Board will consider the PMT for final approval.

Steps in the PMT Process

There were five main steps in the development of the PMT: "visioning," project screening, project evaluation, review of the draft PMT, and finalization of the PMT.

Visioning

Development of Vision, Goals, and Objectives

The first step was "visioning," open-ended brainstorming with local and regional officials and other members of the public to define the

region's future transit system. In this open process, the PMT project team solicited any ideas members of the public might have for improvements to meet current and future transit needs. Input was also requested on the PMT vision statement, goals, and objectives.

The MBTA opened public discussion on the PMT process in the summer and fall of 2001 by convening the PMT Working Committee, conducting a series of eight public workshops, and inviting many local and regional groups to discuss the PMT.

First, a vision statement was completed to define the role of public transportation in eastern Massachusetts's transportation network in 2025. Next, goals and objectives were drafted to outline the strategy for implementing this vision as part of the MBTA's planning process. The Working Committee, as well as members of the public, provided input to the development of these important policies. Committee members were particularly interested in the PMT establishing values and a clear and forward-looking vision that would support well-defined goals. Achieving a state of optimal repair was important. Protecting the environment (including minimizing impacts), supporting sustainable development, and, particularly, taking steps to improve air quality and slow climate change were serious issues for the committee.

The PMT Vision for Public Transportation

The MBTA has adopted the following vision for public transportation.

- Provide safe, cost-effective, and efficient services that increase ridership and respond to the expanding mobility demands of individuals and communities.
- Maintain existing infrastructure in a state of optimal repair to improve quality, convenience, accessibility, and reliability of service.

Ashmont Station

- Transport customers in a system that promotes a desirable quality of life, supports the sustainable development of communities, improves the quality of the environment throughout the Massachusetts Bay region, and distributes benefits and burdens equitably.

The PMT Goals and Objectives

The vision of the PMT will be implemented through these numbered goals and their corresponding objectives.

1. Preserve and modernize the transit system and improve accessibility.
   - Support infrastructure projects that improve customer service, ensure the safety and security of passengers, and enhance the efficiency of the system.
   - Adhere to a timely schedule for infrastructure maintenance.
   - Provide better access to the system for all customers, with particular focus on meeting the goals of the Americans with Disabilities Act.
2. Improve mobility for area residents and visitors now and in the foreseeable future.
   - Increase transit mode share in the Massachusetts Bay region.
   - Provide transit access to commercial and

residential centers both in the urban core and the suburbs, taking into account anticipated growth.

- Enhance the interconnectivity of all transit services by promoting seamless transfers at intermodal facilities, eliminating the need for transfers where possible, and providing improved customer information on available connections.
- Improve the on-time performance of MBTA services through improved monitoring of routes and modifications to rights-of-way.

3. Minimize transportation-related pollution of the environment.
   - Reduce the MBTA's environmental impact on the Commonwealth by implementing projects and programs that increase the use of low-polluting fuels and efficient engine technology in all transit vehicles and that reduce greenhouse gas and particulate matter emissions.
   - Minimize community disruption and negative environmental impacts.
   - Construct and operate facilities that reduce traffic congestion and improve air quality by providing residents of the Massachusetts Bay region with an attractive alternative to traveling in private automobiles.
4. Promote the equitable sharing of the transportation system's benefits and burdens.
   - Expand capacity and reallocate resources to relieve passenger crowding on vehicles and facilitate ridership growth.
   - Identify and remove structural and operational transportation barriers faced by disadvantaged populations.
   - Enhance the mobility of transit-dependent populations located both in the urban core and suburban areas.
5. Serve as partner for community development within the MBTA service area.
   - Implement transportation investments that sustain and stimulate regional economic development.
   - Respond to communities' requests for transportation improvements that support transit-oriented development and sustainable-land-use plans.
   - Improve mass transportation in a manner that enhances the competitiveness of local businesses and the economic vitality of neighborhoods, with special emphasis on disadvantaged areas.

Development of the Universe of Project Ideas

The MBTA then developed the Universe of Projects (Universe), the set of all projects considered in the PMT. An important part of this effort was the project-level review of previous PMTs and other MBTA planning documents, the Capital Investment Program, the State of Good Repair Program, the Parking Expansion Program, and other various studies conducted to support capital investment planning by the MBTA. The 2000–2025 Regional Transportation Plan was also reviewed. The results of this work provided the essential, baseline inputs to the set of projects considered for inclusion in the PMT. Extensive public outreach and review by the Working Committee, the MBTA Advisory Board, and members of the public yielded hundreds of project ideas to supplement the initial list. Many ideas were new, broadening the PMT's viewpoint.

At the end of the visioning phase, the PMT team had developed a Universe, which included ideas for transportation improvements in all modes, and consensus on the PMT vision, goals, and objectives. (Please see the Appendices for a complete listing of the Universe.)

Project Screening

Working with the Universe that emerged from the visioning phase, the MBTA and the Working Committee reduced the Universe to a shorter, feasible list of projects that warranted further evaluation. A set of screening criteria, reviewed with the Working Committee and the MBTA Advisory Board, identified issues to be considered in this process. These screening criteria, along with performance measures to be described in the following section, are consistent with the MBTA's amended enabling legislation. A project's ability to meet an identified need or an existing legal commitment was an important consideration. Environmental justice issues, such as ensuring equitable provision of service to minority and low-income communities, and whether a project was included in the 1994 PMT were also taken into account. Community support and coordination with local plans were considered. Concepts that were technically infeasible, currently impracticable, or inconsistent with established MBTA transit priorities were separated out of the Universe. Some of the suggestions did not require additional capital resources for implementation and were referred to the MBTA's service planning process. System preservation projects were included in the Universe without undergoing screening.

The MBTA Advisory Board was briefed during the screening process. The Working Committee discussed the screening at two of its meetings, and consensus was reached on the projects to be advanced. These projects were organized into three categories—system preservation, service enhancements, and system expansion. (The Universe of Projects and the screening results are shown in Appendix E.)

Commuter rail–Hamilton/Wenham Station

Project Evaluation

Projects that emerged from the screening phase were evaluated using performance measures to determine how well each met the PMT goals and objectives and other regional transportation planning priorities.

Performance Measures

The MBTA developed sets of performance measures for each of the three categories of projects, which are described below.

- System Expansion: Projects which introduce service to an area or time period where it currently does not exist, or convert an existing service to a new mode. Rapid transit, bus, trackless trolley, commuter rail, and boat projects were identified.
- Service Enhancements: Projects that would improve the quality of service provided on an existing transit line or at an existing station. These were organized into general enhancements, accessibility projects, and projects improving access to service.
- System Preservation: Projects aimed at keeping the MBTA's system in a state of optimal repair.

Project ideas were then further divided by mode. Commuter rail, rapid transit, bus/trackless trolley, boat, and other modal (including pedestrian and bicycle) ideas were evaluated separately. This resulted in eight overall groupings of projects—system expansion and service enhancement projects for all modes except for boat and other modes. Only system expansion

projects were submitted for consideration under the boat mode, and only service enhancement projects were submitted for the "other modes" grouping.

System expansion and general service enhancement project ideas were evaluated based on thirty-five individual performance measures divided into seven categories as listed below. Additional detail is provided in Appendix A.

- ***Utilization***
  Total ridership; new transit riders; travel time benefit; impact on mode share to key destinations, including downtown Boston; and reductions in crowding and vehicle miles traveled.

- ***Mobility***
  Expansion of transit access to geographical areas underserved by transit; during time periods poorly served by transit; and to major employment centers underserved by transit.

- ***Cost-Effectiveness***
  Capital cost and operating costs per new transit rider and per unit of travel time savings.

- ***Air Quality***
  Percent reduction and capital cost per unit reduction in emissions of volatile organic compounds, nitrogen oxide, carbon monoxide, and carbon dioxide.

- ***Service Quality***
  Enhancements to customers' personal safety; improvements to station access and/or comfort of vehicles and stations, to reliability of service, to interconnectivity between modes (including nonmotorized modes), and to customer information, including navigational tools; and elimination of transfers/minimization of transfer time.

MBTA bus and Silver Line vehicle–Washington St.

- ***Economic and Land Use Impacts (not applied to service enhancement projects)***
  Service to a state-designated revitalization area/initiative; consistency with local plans that promote coordinated, transit-oriented development and support sustainable land use patterns in the immediately surrounding area(s); consistency with regional plans; and support for brownfield and infill development.

- ***Environmental Justice***
  Service to minority, low-income, and transit-dependent neighborhoods; rectification of structural and/or operational transportation barriers faced by minority, low-income, and transit-dependent neighborhoods; response to environmental justice issues identified in MPO Regional Transportation Plans, including poor connections between targeted residential neighborhoods and major employment centers; and burdens and benefits to minority, low-income, and transit-dependent neighborhoods.

  These measures are consistent with the Boston MPO's environmental justice policies and performance measures, developed in its consultation with representatives of low-income and minority communities in the region.

The Working Committee reviewed the evaluation measures and offered refinements over the course of several of its meetings. Members

wanted to make sure that the criteria addressed the goals and objectives. They supported improving mobility, particularly to areas with unmet demands, and wanted the PMT to reflect current views on development by giving priority to transit projects serving transit-oriented development. They also strongly supported service improvements to environmental justice target communities. The performance measures were also discussed with the Capital Planning Committee of the MBTA Advisory Board. Other members of the public were invited to comment through the PMT Monitor, the newsletter *TRANSREPORT*, and the PMT Web site.

The Evaluation Process

For each performance measure that was applicable to a given project, a high, medium, or low rating was assigned. In the case of quantitative measures, the thresholds for high, medium, and low ratings were defined by first listing the corresponding impacts of all projects in a given grouping in order of magnitude. Natural breaks, or large gaps between the impacts of successive projects in the list, were then identified, and the first grouping was given a high rating, the second group a medium rating, and so on. This resulted in a set of ratings for individual projects that were relative in nature.

In the case of qualitative measures, the thresholds for high, medium, and low ratings were defined before their application to specific project ideas. Additional details on these definitions for each measure are included below. In some cases, the vast majority of project ideas received the same rating on a given qualitative performance measure, unlike the approach for quantitative measures. For example, almost all project ideas that would have an impact on environmental justice target communities were determined to not result in a substantial burden on those communities without a commensurate benefit. Consequently, almost all projects received high ratings on that measure.

Green Line–Coolidge Corner

Evaluation information was reported in tabular form using three symbols to describe each project's rating in every performance area:

- high rating ●
- medium rating ◗
- low rating ❍

Projects then fell into three overall groupings, and those with the highest overall evaluations were designated as high priority; those in the middle, medium priority; and those satisfying the fewest performance measures, low priority.

Review of Preliminary Results and Draft PMT

The preliminary results of this analysis were discussed initially with the Working Committee and with MBTA operations, planning, and finance personnel. The MBTA then conducted four workshops around the region to gather input from members of the general public on the evaluation process and preliminary results. These were similar in format and outreach method to the initial eight conducted in 2001. The Regional Transportation Advisory Council, the Access Advisory Board to the MBTA, and the Boston MPO's Environmental Justice Committee participated in the public review. The additional information from these sources was considered and revisions were incorporated in a draft PMT document.

The draft PMT was circulated for public review during a thirty-day comment period. Notice of its availability was advertised in legal notices of the major daily newspaper, posted on the PMT Web site, and sent to members of the Working Committee, the MBTA Advisory Board, the state legislature, and the Regional Transportation Advisory Council. Regional transit authorities, MAPC subregions, and the chief elected officials, administrators, and planning directors of municipalities throughout the MBTA service area were also contacted. Notice of the PMT's availability was announced in *TRANSREPORT* and was sent to the hundreds of citizens and officials on the Boston MPO's and the PMT's public information mail distribution lists. Two public hearings were held to listen to comments. Special briefings for the Boston MPO's Transportation Planning and Programming Committee were also conducted.

Finalizing the PMT

All comments received during public review were considered and, as appropriate, incorporated into the PMT, which was then sent to the MBTA Board of Directors for approval. Final acceptance rests with the MBTA Advisory Board.

Partners in the Process

The broad scope of the PMT called for significant public involvement. The MBTA sought many perspectives and ideas through its public process initiatives, which reached into every corner of the service area to attract individual members of the public, officials, and organizations. Through the PMT Working Committee, the MBTA developed an ongoing and in-depth dialogue with stakeholders in the region's transit system. The 2003 PMT has been shaped by this public input and guidance and reflects a balance of technical analysis, operational issues, and public perspectives.

The PMT Working Committee

The PMT Working Committee

The PMT Working Committee served as the MBTA's principal public advisory body in developing the PMT. The sixteen members making up the initial committee were selected from a wide geographic area and a variety of views and interests. Members represented the City of Boston, state agencies, regional agencies and groups (including several participants from the MBTA Advisory Board, the Regional Transportation Advisory Council, and the Access Advisory Committee to the MBTA), and a community group. They were asked not only to provide their organization's views during PMT discussions, but also to relay information and views from the Working Committee back to their group. This way, their voices reflected the issues important to their constituents, and their constituents input was informed by a good awareness of how the PMT's development was proceeding.

The Working Committee met frequently, usually monthly, to review PMT work products and to provide advice and guidance in the development of the PMT. Early activities focused on building members' knowledge base about MBTA financing, the Capital Improvement Program, the parking expansion program, system preservation analysis, environmental justice, and travel demand modeling.

From this base, members participated in every step of the PMT. They provided input and guidance on PMT policies (the vision, the goals and objectives), project performance measures, and development of the final plan. The committee identified specific project ideas for inclusion in the PMT and raised issues for discussion. (See the Appendices for a list of committee members and meeting notes.

The MBTA Advisory Board

The MBTA consulted with the MBTA Advisory Board on several levels throughout the development of the PMT. As the final decision-maker on acceptance of the 2003 PMT, the Advisory Board plays a key role in the process. In order to ensure that issues of importance to the Advisory Board were addressed, the MBTA provided several briefings to the entire body and discussed the PMT often with its Capital Planning Committee. In particular, the Board provided input for the Universe of Projects and the PMT goals and objectives.

Metropolitan Planning Organizations

The Boston Metropolitan Planning Organization

The Boston MPO was important in the development of the PMT. Its Regional Transportation Plan provided one of the early inputs for the PMT Universe of Projects. The PMT vision, goals, and objectives are consistent with the MPO's policies. MPO members, through their Transportation Planning and Programming Committee designees, were provided several briefings and opportunities for comment.

Pedestrians near Arlington Station

Environmental Justice

The Boston MPO's standing committee on environmental justice is assisting the MPO with ensuring that all of its regional planning efforts consider the needs of low-income and minority communities. The aim is to strengthen the connections between the region's transportation planners and the individuals and front-line organizations playing a direct service or community development role in improving conditions in low-income and minority neighborhoods. The PMT incorporated the Boston MPO's environmental justice policies in its analysis and will review the results with the Environmental Justice Committee.

The Regional Transportation Advisory Council

Though not directly in the line of PMT approval, the Boston MPO's Regional Transportation Advisory Council is responsible for citizens' review of and input to the MPO's products and processes. Because of its active role and members' regional perspective on transportation planning, the Council was represented on the Working Committee and was briefed periodically by PMT staff.

Other MPOs/Regional Planning Agencies

As part of the initial outreach, the MBTA met with each of the MPOs that have communities in the MBTA service area through the regional planning agencies corresponding to the MPOs: the Old Colony MPO (Old Colony Planning Council), the Southeastern Massachusetts MPO (Southeastern Regional Planning and Economic Development District),

Central Massachusetts MPO (Central Massachusetts Regional Planning Commission), Montachusett MPO (Montachusett Regional Planning Commission), Northern Middlesex MPO (Northern Middlesex Council of Governments), and the Merrimack Valley MPO (Merrimack Valley Planning Commission). These meetings helped the MBTA build valuable relationships and opened the door for ongoing communication.

Interest Groups

Early in the PMT process, the MBTA conducted an initial outreach to more than fifty local or regional organizations. Some, such as the Access Advisory Committee to the MBTA, have a very specific role in transit planning. Others, such as the Metropolitan Area Planning Council subregions, have a longstanding interest in transit planning. Many of the other groups contacted are not normally active in transit planning discussions, but the MBTA wanted to gather a broad range of views and hear from people not previously involved. Neighborhood and community groups around the service area were asked to devote a portion of a regularly scheduled meeting to a PMT briefing. The discussions served as both an invitation to submit ideas for the PMT and an opportunity to explain the MBTA planning process. (See the Appendices for a listing of organizations contacted.)

Members of the Public

Twelve public, widely advertised workshops were conducted in accessible locations all around the region. The first round was conducted in November and December 2001 and served to introduce the PMT and the MBTA planning process, and to actively solicit ideas and comments. The second round, conducted in January 2003, reviewed the PMT process, the evaluation criteria, and the preliminary results of the analysis. The open-house, workshop format of these events allowed members of the public to visit numerous "stations" set up to stimulate ideas about rapid transit, bus, commuter rail, commuter boat, and bicycle/pedestrian transportation. Maps showing transit routes, lines, and other facilities were available for discussion, and participants used them to show their ideas for transit improvements. Some people also submitted written comments. All ideas and input collected at the workshops were addressed in the PMT process. Some suggestions provided ideas for projects and insights and guidance on policy issues. For example, members of the public were often interested in environmental justice issues and enhancing mobility to key employment centers. They also spoke about service quality issues such as improving reliability and eliminating transfers.

Two public hearings were also held by the MBTA in early March 2003 to solicit final comments on the draft PMT. Unlike the earlier workshops, these hearings did not provide the opportunity for dialogue with the MBTA staff, but the proceedings were recorded by a stenographer and are addressed in Appendix D.

Public Information

The *PMT Monitor,* the project's newsletter, provided current information and progress reports on the development of the PMT and on Working Committee activities. It announced workshops, presented the project schedule, showed progress through the phases of PMT development, and invited readers to provide input and ideas. Three editions were published and they were circulated widely. They were posted on the PMT Web site and mailed to chief elected and executive officers and planning boards in the MBTA-service-area communities outside the Boston MPO area. Within the Boston MPO region, copies were sent to the MPO's e-mail group, MPOINFO, which includes all selectmen's and mayors' offices, town administrators, planning directors, legislators, and many interested citizens—approxi-

mately 550 recipients. The newsletter was also sent to everyone (570 people) on the PMT mailing list, which consisted of individuals who attended public meetings and expressed interest in being kept informed.

Information from the *PMT Monitor* was published in articles in the Boston MPO's newsletter, *TRANSREPORT*, which is circulated to more than 2,550 readers in the MPO region. *TRANSREPORT* also included notices of the workshops held to solicit initial project ideas and to review preliminary results. Separate notices were placed in advance of the official public review period and the March 2003 public hearings: press releases were sent to local and regional newspapers in the MBTA service area, and a legal notice was also placed.

The project team established a PMT Web site, linked to both the MBTA and the Boston MPO Web sites. The PMT site included general information on the project, notices of the public workshops and hearings, and information on the Working Committee and PMT-development products such as the vision statement, goals and objectives, project screening criteria, performance measures, and results of both the project screening and the full project evaluations. The site also provided an electronic form for citizens to use to register ideas and comments or request more information.

Comments

Citizens submitted ideas in a variety of ways: via the Web site's public comment form; at workshops, using written comment forms or large-scale paper maps; and via traditional correspondence. All comments were considered in the development of the PMT.

CHAPTER 2

Existing Conditions

The MBTA is the primary transit provider in eastern Massachusetts, and its system is one of the five largest public transportation systems in the United States. It directly operates or contracts out for service using eight different modes: heavy rail, light rail, bus rapid transit, local/express bus, trackless trolley, commuter rail, commuter boat, and paratransit. Its system serves the area in a largely hub-and-spoke network. The commuter rail network extends to the far reaches of the MBTA's 175-community district, while local MBTA bus service extends from Boston to just beyond Route 128. Rapid transit, streetcar, and bus rapid transit service is limited to communities within Route 128.

Boston stands among five other national urban areas—Chicago, New York, Philadelphia, San Francisco, and Washington—as a megacity in which transit carries more than 3 percent of all passenger miles and more than 8 percent of commuter travel. The "big six" carry two out of three of the transit passenger miles traveled in America. In Boston, 55 percent of all work trips and 42 percent of all trips into downtown are by transit. In the Boston MPO region overall, 6.8 percent of all trips are made by transit, and that number is estimated to increase to 7.47 percent by 2025.

Rapid Transit, Light Rail, and Bus Rapid Transit

The MBTA rapid transit, light rail, and bus rapid transit systems serve 134 stations on six lines: the Green Line, Blue Line, Orange Line, Red Line, Mattapan High Speed Line, and Silver Line. Daily ridership on the rapid transit/light rail system is over 689,000, with over 10,000 riders per weekday on the bus rapid transit system. In this chapter, all ridership data is a composite average and is reported as unlinked trips.

Green Line

Opened on September 1, 1897, the Green Line has been providing transit riders in Boston with service for more than a century and is the oldest operating underground subway in the United States. The

original underground alignment ran along Tremont and Boylston Streets between Park Street and the Public Garden, and the majority of this route is still in use today. Realignment in 1914 resulted in the closure of the Public Garden portal and the opening of a new underground tunnel under Boylston Street to Copley Square. Between 1897 and 1959, the Green Line underwent extensive expansion, with branch lines added, realignments of tracks and portals, and vehicle upgrades. This era of Green Line expansion ended with the conversion of the Highland Branch, a former heavy rail right-of-way, into the present-day D Line extending to Riverside in Newton.

Today, the Green Line uses light rail vehicles (LRVs) and generates approximately 215,000 trips per weekday over 23 miles of track in Cambridge, Boston, Brookline, and Newton. The line operates both above and below ground along the four branch lines and within the central subway. There are a total of 70 stations on the Green Line. The number of stations on each branch is as follows:

Blue Line–Aquarium Station

- Central Subway – 13 stations
- B Line – 22 stations
- C Line – 13 stations
- D Line – 13 stations
- E Line – 9 stations

The northern terminus of the Green Line's E and D branches is at Lechmere Station in Cambridge. Because Green Line ridership north of downtown Boston is much lower than to the west and southwest, B Line and C Line trains turn around at Government Center. There are 170 light rail vehicles in the Green Line fleet, which consists of 55 cars built in 1976–78, 95 built in 1986–87, and 20 built in 1997. One hundred ten (110) passengers per car is considered the maximum load for these vehicles. Delivery of 100 new low-floor cars began in 1999. These cars are intended to replace the 55 cars built in 1976–78 and are designed to be accessible to the disabled and elderly.

Park-and-ride facilities on the Green Line provide over 1,900 spaces. Rush hour trains operate at 5- to 8-minute intervals on the four branches and at 1.3-minute intervals between Copley and Government Center Stations. The peak hour directional line capacity totals 9,020 passengers.

Blue Line

The six-mile-long Blue Line is the shortest of the three heavy rail lines and operates between Wonderland Station in Revere and Bowdoin Station in the Government Center area of Boston. Built in 1904, the Blue Line was originally a streetcar line between Court Street in Boston and Maverick Square in East Boston. In 1924, it was converted to high-platform, third-rail rapid transit. Over the years, expansions have included new stations and vehicle upgrades.

Twelve stations, eight of which are currently accessible, generate 59,394 weekday trips. These trips are generated primarily as inbound and outbound work trips. The Blue Line fleet consists of 70 vehicles built in 1978–80; 95 passengers per car is considered the design load. Park-and-ride facilities provide over 3,900 spaces. Rush hour trains operate at 3.5-minute intervals at an average speed of 18.7 mph. All trains are four cars in length at all times, and

the peak hour directional line capacity totals 6,460 passengers.

At present, the Blue Line is undergoing major reconstruction work at Airport and Aquarium Stations to comply with the Americans with Disabilities Act (ADA) requirements. Reconstruction of stations at Government Center, Maverick, Orient Heights, and State is also planned. The MBTA has procured a new fleet of 94 vehicles for Blue Line service and will run six-car trainsets once all construction work is completed.

Orange Line

Opened in June 1901, the Orange Line began as an elevated railway between Sullivan Square in Boston and Dudley Square in Roxbury. Over the decades, the Orange Line was routed underground via a tunnel under Washington Street, it was extended to Everett and to Forest Hills in Jamaica Plain, and portions of its elevated tracks were removed. In 1987, the Orange Line underwent its biggest change when the line was rerouted to the Southwest Corridor (originally designated for a new highway in the 1970s) into a below ground right-of-way where it presently operates.

The existing Orange Line, a rapid transit line is 11 miles long and operates between Oak Grove on the Malden/Melrose line and Forest Hills, serving the municipalities of Malden, Medford, and Boston. Sixteen of its 19 stations are accessible, and 170,873 trips are generated each week day. The Orange Line fleet consists of 120 vehicles built in 1979–81. During the peak period, 130 passengers per car is considered the design load. Park-and-ride facilities provide over 5,400 spaces.

The MBTA runs six-car trains during weekday peak and midday hours and four-car trains at all other times. Rush hour trains operate at 5-minute intervals at an average speed of 20.2 mph. The peak hour directional line capacity is approximately 10,140 passengers. The MBTA plans to improve the signal system between Haymarket and Oak Grove to match the signal capabilities already in place on the remainder of the line.

Red Line

Of the three rapid transit lines, the Red Line is the longest, at 21 miles, and the most heavily utilized, generating an average of 226,812 trips per weekday. Opened in March 1912 and expanded over the decades, the present Red Line has 22 stations, 17 of which are accessible. Service runs on two branches, from Alewife Station in North Cambridge to either Ashmont Station in Dorchester or Braintree Station. The municipalities directly served are Cambridge, Somerville, Boston, Quincy, and Braintree. All service operates along a common alignment between Alewife and JFK/UMass Station in Dorchester, at which point service branches off to either Ashmont or Braintree.

Throughout most of the day, service is split equally between the two branches. The MBTA runs six-car trains during the A.M. and P.M. peak hours and four-car trains at other times. There are 218 cars in the Red Line fleet. The fleet consists of 74 cars built in 1969, 58 cars built in 1987–88; and 86 cars built in 1994. During the peak period, 170 passengers per car is considered the design load. Park-and-ride facilities provide over 11,000 parking spaces.

Rush hour trains operate at 8-minute intervals from Braintree and Ashmont and at 4-minute intervals between

Orange Line–Roxbury Crossing Station

JFK/UMass and Alewife. Average speeds on the Braintree and Ashmont Branches are 23.3 mph and 19.2, mph respectively. The peak-hour directional line capacity totals 12,200 passengers.

Mattapan High Speed Line

The Mattapan High Speed Line connects with the Red Line and operates between Ashmont and Mattapan Stations through the Dorchester neighborhood of Boston and the town of Milton. The 2.7-mile line has 8 stations, with cars operating at 5 minute intervals during peak periods and at 10-13 minute intervals at all other times.

The High Speed Line uses 10 President's Conference Committee (PCC) streetcar vehicles built in 1945–46. These PCC cars are the oldest operating revenue vehicles on the entire MBTA system. A program to restore the cars and extend their service life by at least an additional 10 years is ongoing, with 6 of the 10 having been restored and a seventh in the process. The cars are being restored to the orange and cream paint design that was used when the vehicles were first delivered to the Metropolitan Transit Authority, the predecessor to the MBTA.

The High Speed Line can be considered an extension of the Red Line, in most respects, as it connects with Ashmont Station. Its vehicles, however, are maintained and operated as part of the Green Line fleet and run as single cars. Eighty-seven passengers per car is considered the maximum load. The line has over 300 parking spaces and generates 7,752 passenger trips per weekday.

Silver Line

In July 2002, the first phase of the Silver Line, the MBTA's newest rapid transit line, opened between Dudley Square and Downtown Crossing along Washington Street in Boston. The route, which was part of the elevated Orange Line until 1987, is a bus rapid transit (BRT) line that consists of a busway featuring priority lanes, shelters, real-time schedule information, electronic signage, a public address system, and an intercom assistance system. Currently, 17 forty-foot compressed natural gas (CNG)–powered buses operate on the 2.2-mile line. Four-minute intervals are provided during peak-periods. These buses will be replaced in 2003 with sixty-foot articulated buses. Ridership on the Silver Line is over 10,000 passenger trips per weekday.

The second phase of the Silver Line is presently under construction and is expected to open in December 2003. Service on this segment will operate from South Station to Logan

TABLE 2–1
CHARACTERISTICS OF THE RAPID TRANSIT SYSTEM

Line	Fleet Size	Passenger Trips per Weekday	Length of Line (in miles)	Headway (in minutes)
Red Line	218	226,812	21.0	4.0
Green Line	170	215,000	23.0	1.3
Orange Line	120	170,873	11.0	5.0
Blue Line	70	59,394	6.0	3.5
Silver Line	17	10,000	2.2	4.0
Mattapan High Speed Line	10	7,752	2.7	11.0

Note: 1.3-minute Green Line headway is between Government Center and Copley, and 4-minute Red Line headway is between Alewife and JFK/UMass.

Airport via an underground transitway, with stops at the John Joseph Moakley Federal Courthouse and the World Trade Center connecting with the Ted Williams Tunnel to go to Logan. A branch surface route will connect to the new Boston Convention and Exhibition Center and the Boston Marine Industrial Park in South Boston.

The plan for the third phase of the Silver Line is to connect the Washington Street and South Boston segments between New England Medical Center and South Station. A pre-existing tunnel under Tremont Street between New England Medical Center and Boylston Stations would be built, along with another tunnel from Boylston Station to South Station via Chinatown. Efforts to secure funding for this phase are underway, with the goal of completion by 2010.

Bus and Trackless Trolley

The MBTA operates approximately 170 bus routes serving the following 44 municipalities:

> Arlington, Bedford, Belmont, Beverly, Boston, Braintree, Brookline, Burlington, Cambridge, Chelsea, Danvers, Dedham, Everett, Hingham, Holbrook, Lexington, Lynn, Malden, Marblehead, Medford, Melrose, Milton, Nahant, Needham, Newton, Norwood, Peabody, Quincy, Randolph, Reading, Revere, Salem, Saugus, Somerville, Stoneham, Swampscott, Wakefield, Walpole, Waltham, Watertown, Westwood, Weymouth, Winchester, Woburn

Four electric trackless trolley lines provide additional service in the communities of Cambridge, Watertown, and Belmont. Total bus and trackless trolley ridership is approximately 376,000 trips per weekday.

Nearly all bus and trackless trolley routes connect with the rapid transit system. In areas close to the Boston core, buses provide crosstown service, feeder service to rapid transit

MBTA bus–Hyde Park Ave.

stations, and line-haul service (in heavily congested areas). Outside the urban core, buses provide local service and feeder service to rapid transit and some commuter rail branches.

The MBTA bus fleet consists of 366 diesel buses built in 1985–87, 194 diesel buses built in 1989, 396 diesel buses built in 1994–95, and 4 alternative-fuel vehicles built in 1999. The fleet also includes 40 electric trackless trolleys built in 1976. The MBTA is in the process of procuring additional alternative-fuel buses, including CNG buses, dual-mode vehicles for the South Boston Piers Transitway, and new trackless trolleys to replace the present fleet. Currently, the average age of the entire fleet is 11.79 years. It is estimated that by 2005, the average age will be 4.49 years.

The MBTA also operates express bus service to Boston from 12 communities:

> Burlington, Lynn, Marblehead, Medford, Nahant, Newton, Salem, Saugus, Swampscott, Waltham, Watertown, Woburn, and the Boston neighborhood of Brighton.

MBTA buses serve over 8,600 stops, approximately 355 of which are equipped with bus shelters. Park-and-ride lots for bus service have over 400 parking spaces. The present MBTA bus network consists mostly of routes taken over from the Metropolitan Transit Authority in 1964 and from several private operators at

various points in time. Most of these routes have lengthy histories, and many had their origins as streetcar lines built before 1900. Schedules and route alignments have been revised gradually over the years, but most continue to operate along the same general alignments in response to continuing demand.

Commuter Rail

The history of the commuter rail system begins in the mid-1830s. The three original railroads that came to Boston at that time were the Boston & Worcester, Boston & Providence, and Boston & Lowell. These lines constituted Boston's first commuter rail system. Over the decades, the system has adapted to the employment patterns of its customers and expanded with the addition of other railroad lines. In the 1960s and 1970s, the MBTA incrementally became owner and operator of the commuter rail system.

The present MBTA commuter rail network is comprised of 13 radial lines, with 123 stations (81 of which are accessible) and 365 miles of track. Ridership per weekday is over 140,000 passengers. The commuter rail system feeds two different downtown Boston terminals. North Side service operates to and from North Station, and South Side service to and from South Station. The Massachusetts Turnpike is generally considered the dividing line between North and South Station service. All routes

Commuter rail–Westborough Station

north of the Turnpike—the Rockport, Newburyport, Haverhill, Lowell, and Fitchburg lines—serve North Station. Lines along the Turnpike or to the south—the Framingham/ Worcester, Needham, Franklin, Attleboro/ Providence, Stoughton, Fairmount, Middleborough/Lakeville, and Kingston/ Plymouth Lines—have South Station as their terminus. Back Bay Station is served by the Framingham/ Worcester, Needham, Franklin, Attleboro/ Providence, and Stoughton Lines.

The 76 municipalities served directly by commuter rail are:

> Abington, Acton, Andover, Ashland, Attleboro, Ayer, Belmont, Beverly, Billerica, Boston, Braintree, Bridgewater, Brockton, Cambridge, Canton, Chelsea, Concord, Dedham, Fitchburg, Framingham, Franklin, Gloucester, Grafton, Halifax, Hamilton, Hanson, Haverhill, Holbrook, Ipswich, Kingston, Lakeville, Lawrence, Leominster, Lincoln, Littleton, Lowell, Lynn, Malden, Manchester, Mansfield, Medford, Melrose, Middleborough, Natick, Needham, Newburyport, Newton, Norfolk, Norwood, Plymouth, Providence (RI), Quincy, Randolph, Reading, Rockport, Rowley, Salem, Sharon, Shirley, Southborough, Stoughton, Swampscott, Wakefield, Walpole, Waltham, Wellesley, Wenham, Westborough, Weston, Westwood, Weymouth, Whitman, Wilmington, Winchester, Woburn, Worcester

The Attleboro/Stoughton Line is the most heavily used line, with an average of 10,300 persons boarding per weekday. This line extends to Providence, just over the Massachusetts–Rhode Island border which contributes to its high ridership. In contrast, the Fairmount Line is the only commuter rail line that operates exclusively within the inner core of Boston, yet it has the lowest ridership, in part because of its small number of stops and its

low frequency compared to nearby bus routes. The Fitchburg Line is the longest in the commuter rail system, at 49.5 miles. Commuting times per mile on the Fitchburg Line are the greatest in the system, because of close stop spacing, speed restrictions, along the line and lack of express train service.

The commuter rail passenger coach fleet consists of 378 vehicles: 57 single-level coaches built in 1979 and rebuilt in 1996, 214 single-level coaches built in 1987–90, 75 double-deck coaches built in 1990–91, 17 double-deck coaches built in 1997, and 15 double-deck coaches delivered in 2001–2002. Double-deck coaches have seating capacities of 182, versus 127 for a single-level car.

The commuter rail locomotive fleet consists of 83 units: 18 units built in 1978–80, 25 units built in 1987–88, 12 units built in 1991–93, and 25 remanufactured units delivered in 1997–99. The fleet also includes 3 work locomotives built in the 1950s, which are used for non-revenue duties.

Of all of the components of the MBTA's transportation network, the commuter rail system serves the broadest market geographically, but it carries fewer passengers than the rapid transit system. A total of 457 weekday inbound and outbound trips are scheduled, with headways ranging from 25 to 40 minutes during peak periods, and from one to four hours during off-peak times. Over 30,000 park-and-ride spaces are provided for commuter rail riders, or are under construction.

Commuter Boat

Modern-day commuter boat service is a relatively new component of the public transportation system. In the early 1800s, steamboats ran to Boston from several coast communities. With the construction of the railroads in the mid-1800s, the market for boat service was reduced to seasonal and recreation travel. Boat service in Boston was not significantly used as a commuter alternative again until the 1970s.

Commuter boat–Rowes Wharf

Commuter boat service is provided on five routes by both the MBTA and subsidized private contractors. The routes operate between:

- Hingham and Rowes Wharf (Boston)
- Point Pemberton (Hull) and Long Wharf (Boston) via Quincy Shipyard (Quincy)
- Charlestown Navy Yard and Long Wharf
- Charlestown Navy Yard and Lovejoy Wharf (Boston)
- Lovejoy Wharf and the World Trade Center via the John Joseph Moakley Federal Courthouse (Boston)

Commuter boat service from Hingham originated in 1975 and was subsidized by the state between 1977 and 1981. During the 1980s and early 1990s, a number of renewed state-funded contracts and private operators provided commuter boat service on the route. In July 1997, the MBTA awarded a contract for the Hingham route to Harbor Cruises, LLC, a consortium that included Boston Harbor Cruises, Inc., which had been running commuter boat service between Long Wharf and the Charlestown Navy Yard since the 1980s.

Ferry service began operating from Hull in the mid-1850s as a steamboat service; by the 1890s it was being used primarily as a recreational service to Nantasket Beach, Paragon Park, and

other amusement areas in Hull. In 1963, a newly formed Mass. Bay Lines took over the Hull service and operated one round-trip per day, with a schedule suitable for Boston commuters. By 1967, the route was averaging about 40 riders each way per day. Service was discontinued in 1981 due to a decline in popularity and was reestablished years later under the Bay State, Spray, & Provincetown Steamship Company, which had been running Boston-to-Provincetown cruises for a number of years. Service was provided by the company and its successor, Bay State Cruise Company, without a subsidy until 1997. At that time, a subsidy was provided by the MBTA; however a competitive bidding process changed operators, and Harbor Express took over the route. Service was increased to two round-trips per day; both serve Quincy as well as Boston.

The present Quincy route is the newest of the South Shore commuter boat routes. Begun in December 1996 by Harbor Express, the service provides a direct connection to Logan Airport and Long Wharf. Earlier attempts to run commuter boat service in the 1980s from Marina Bay in Quincy lasted only a short time due to an inconvenient boarding point, high fares, and less frequency than the Red Line from North Quincy. The commuter boat terminal is now located in the former Quincy Shipyard complex on the Fore River. In 2002, the MBTA purchased this terminal from Water Transportation Alternatives, Inc. This purchase also included two catamaran vessels, a loading barge at Long Wharf, parking areas, and miscellaneous equipment for repairs and maintenance. The MBTA is a sub-lessee of the Quincy commuter boat parking facility that holds seven hundred spaces. The land is owned by the Massachusetts Water Resources Authority (MWRA), and it has expressed its intention to not renew the current lease that expires on June 30, 2003. The MBTA may need to acquire this facility in the future to support parking for its ferry customers.

Inner Harbor service is provided via three routes: Charlestown Navy Yard to Long Wharf, Charlestown Navy Yard to Lovejoy Wharf, and Lovejoy Wharf to the World Trade Center and John Joseph Moakley Federal Courthouse. Of the three routes, the Charlestown–Long Wharf route has the highest ridership, and it has constant two-way traffic. In addition to commuters, this route is attractive to tourists traveling to the USS *Constitution* and downtown workers who use it for lunchtime cruises. The Charlestown–Lovejoy Wharf route is the least patronized of the three Inner Harbor routes and serves primarily as a commuter option for residents of Charlestown. The Lovejoy Wharf–World Trade Center/Courthouse route is well used and operates primarily as a commuter route, with significant patronage from Lovejoy Wharf on A.M. trips and from the World Trade Center and Courthouse on P.M. trips. All Inner Harbor routes are accessible to persons with disabilities, and all stops connect with MBTA ground transportation.

MBTA ferry services operate between 6:00 A.M. and 10:30 P.M., with a total of 108 weekday inbound and outbound trips scheduled. Ridership is approximately 1.4 million passengers annually. Service is provided by a variety of boats and catamarans, and a total of 1,815 parking spaces are provided at the Hingham, Hull, and Quincy terminals.

Key Stations Program

The Americans with Disabilities Act (ADA), enacted by the federal government in 1990, mandates improvements to a wide variety of facilities and infrastructure throughout the country, for the purpose of providing full access to all. This mandate creates particular challenges for the MBTA, which has some of the nation's oldest transit facilities. The age of the system, combined with the fact that more than half of the MBTA's light rail stations are streetcar stops, resulted in the creation of the MBTA's Key Station Program. This program

designated 80 stations in the MBTA system that must be brought into compliance with ADA guidelines.

The Key Stations Program includes several commuter rail and heavy rail stations that were not previously compliant, most Green Line subway stops, and several important Green Line surface stops. All transfer points between the Blue, Red, Orange, Green, and commuter rail lines are also in the program. Currently, 51 of these 80 stations are compliant, and 27 more are in the design or construction stage. All new stations, such as those on the Silver Line and on the commuter rail extensions to Worcester, Newburyport, Middleborough, and Plymouth, are designed in compliance with the ADA. They are therefore not included in the Key Station Program. The same is true of the recently modernized Blue Line stations.

Mattapan High Speed Trolley–Ashmont Station

In the first few years of the program, the MBTA succeeded in bringing all but seven commuter rail Key Stations into compliance. Since that time, compliance has been achieved at five of the seven stations: Bradford, Fitchburg, Framingham, Canton Junction, and Route 128. Work remains to be done at Fairmount Station and Malden Station. Aside from commuter rail stations, the majority of work that remains in the Key Stations Program is on the Green Line's downtown subway and Green Line surface routes.

Surface streetcar stations included in the Key Station Program overall are those at the transfer points between the Green Line and major bus routes and those that serve large academic and medical institutions. Examples include BU East, BU Central, Harvard Avenue, Washington Street, Boston College, St. Mary's Street, Coolidge Corner, Washington Square, Cleveland Circle, Northeastern, Museum of Fine Arts, Longwood Medical Area, Brigham Circle, and Heath Street/VA Medical Center.

Underground and elevated Green Line stations included in the Key Station plan are Lechmere, North Station, Haymarket, Government Center, Park Street, Arlington, Copley, and Kenmore. The stations on the Riverside Branch are Fenway, Brookline Village, Reservoir, Newton Centre, and Riverside.

Temporary access has been achieved at 13 stations, including Park Street, North Station, and Lechmere, through the use of portable wayside lifts. Construction of raised platforms which are compatible with low-floor cars has been completed at 4 stations on the Riverside Branch. Construction of raised platforms is also planned at surface Key Stations on the B, C, and E Lines. The two terminal stations of the Mattapan High Speed Line are also designated as Key Stations.

Work is presently underway to upgrade (and make accessible) the outbound component of Chinatown Station on the Orange Line. The Orange Line component of North Station was completed in 2001. The Orange Line stations at Malden and Community College will also be made accessible under the Key Station Program. Design work is presently underway to replace Charles/MGH Station on the Red Line, making it accessible. Although not designated as Key Stations, the Savin Hill, Fields Corner, and Shawmut Red Line stations are slated for major renovations that will include providing accessibility for people with disabilities.

Paratransit

THE RIDE is a paratransit service operated by private carriers under contract to the MBTA as an alternative to fixed-route public transportation for persons with disabilities. THE RIDE operates sedans and lift-equipped vans in the following 62 municipalities within the MBTA district:

> Arlington, Bedford, Belmont, Beverly, Boston, Braintree, Brookline, Burlington, Cambridge, Canton, Chelsea, Cohasset, Concord, Danvers, Dedham, Dover, Everett, Framingham, Hingham, Holbrook, Hull, Lexington, Lincoln, Lynn, Lynnfield, Malden, Marblehead, Medfield, Medford, Melrose, Middleton, Milton, Nahant, Natick, Needham, Newton, Norwood, Peabody, Quincy, Randolph, Reading, Revere, Salem, Saugus, Sharon, Somerville, Stoneham, Swampscott, Topsfield, Wakefield, Walpole, Waltham, Watertown, Wellesley, Wenham, Weston, Westwood, Weymouth, Wilmington, Winchester, Winthrop, Woburn


THE RIDE

Annual ridership is over 1 million riders. The program has a fleet of over 300 vehicles.

Private-Carrier and Suburban Bus Service

Four private carriers provide regular local bus transportation in East Boston, Winthrop, Medford, Milton, Canton, Hingham, and Hull under contract to the MBTA. Annual ridership is approximately 691,000 passengers. Nine additional private carriers are subsidized through the MBTA's Interdistrict Transportation Program (ITP) to provide commuter service to downtown Boston from the following 49 communities:

> Amesbury, Andover, Barnstable, Bourne, Boxford, Bridgewater, Canton, Dighton, Dover, Duxbury, Easton, Fall River, Framingham, Georgetown, Groveland, Hanover, Haverhill, Hudson, Kingston, Lawrence, Marlborough, Marshfield, Medfield, Medway, Methuen, Middleborough, Milford, Millis, Newbury, Newburyport, Northborough, Peabody, Plymouth, Raynham, Rockland, Sandwich, Somerset, Southborough, Sudbury, Taunton, Topsfield, Wayland, West Bridgewater, Worcester

Through the ITP, the MBTA also finances local services such as the Framingham LIFT which provides service to the surrounding towns of Ashland, Holliston, Hopkinton, Marlborough, Milford, and Southborough, and a commuter service between Braintree Station and Hanover, Marshfield, and Plymouth. Annual ITP ridership for these local services is approximately 593,700 passengers.

The MBTA also provides funding to local communities to operate their own local transit systems. The Suburban Bus Program is geared toward low-density communities where regular MBTA service would not be cost-effective. The program, which began in 1979, subsidizes 11 communities: Bedford, Beverly, Burlington, Dedham, Framingham, Lexington, Lynn, the Mission Hill neighborhood of Roxbury, Natick, Needham, and Norwood. Some communities operate fixed-route bus service, while others use the program to operate demand-response service with vans or through taxi vouchers. Annual ridership is approximately 452,900 passengers.

Transportation Management Associations

Transportation management associations (TMAs) are nonprofit coalitions of local businesses dedicated to reducing traffic congestion and pollution and to improving commuting options for their employees. Several TMAs support shuttle services which connect employment locations with MBTA rapid transit or commuter rail stations. Some of these services are only available to employees of member companies, while others are open to the general public.

ITS Integration and the MBTA

Intelligent transportation systems (ITS) have a number of useful applications in the provision of transit services. The MBTA is integrating ITS into its operations in several ways. The Operations Control Center (OCC) was upgraded in the late 1990s to provide improved monitoring and location information for the rapid transit system. This control center allows operators to have real-time information on service and accidents and to plan service changes accordingly.

Development of a new bus operations center was started in 2002. When complete, the facility will integrate global positioning systems (GPS) on MBTA buses so that it can better schedule and direct the bus fleet. Automatic stop announcement equipment has been installed on the MBTA's crosstown bus routes, and the Silver Line vehicles are equipped with GPS-based automatic vehicle location (AVL) technology.

The MBTA is moving forward with procuring new fare collection equipment. Both magnetic-strip fare media and contactless "smart cards" are being considered. The MBTA will have some elements of an automated fare collection system implemented by the end of 2004.

The MBTA has advertised for the procurement and installation of interactive travel information kiosks at the South Station Transportation Center. These kiosks would provide a direct link to the MBTA's Web site, where customers could access schedule information for all bus, rail, and boat service. New automatic trip planning functions are also likely to be added to the Web site during the next two years.

Private-carrier bus–Riverside Station

The MBTA is nearing completion of a Request for Proposals to provide an enhanced customer service information system. This system would be tied directly to the MBTA's new vehicle and driver scheduling software now being used by the Scheduling Department. This would allow customers to access next-trip information for all routes over the telephone or the Web. An itinerary-planning tool would also be available to customers on the Web, generating origin-destination routing suggestions without the need to talk to a customer service agent. Other improvements would include TTY capabilities for all customer service agents, in order to reduce telephone-waiting time for persons with hearing impairments.

Access to Jobs and Reverse Commuting

Access to Jobs

The MBTA receives funding from the Federal Transit Administration through the federal Job Access Reverse Commute (JARC) program to

expand the existing fixed-route system to improve access to employment opportunities.

The MBTA operates early morning service (before 6:00 A.M.) from Roxbury, Dorchester, Mattapan, and South Boston to Logan Airport and downtown Boston. Other bus routes serving major suburban shopping centers have also had frequency improvements as a result of this program.

Reverse Commuting

In 2001, the Central Transportation Planning Staff conducted a Reverse Commuting Study for the MBTA. The study examined the feasibility and potential of modifying existing commuter rail schedules to meet the needs of persons working in suburban areas who live in the urban core. It was discovered that, for a number of reasons, the commuter rail network systemwide is currently not well suited to providing reverse commuting service. At the Boston end, most residential areas are beyond walking distance to commuter rail stations, requiring connecting services. At the suburban end, most major work sites are beyond walking distance of stations, requiring connecting van or bus service.

Most employment centers on Route 128 and I-495 are not served directly by commuter rail and only a few are served by feeder buses connecting with commuter rail stations. The Reverse Commuting Study identified potential opportunities for providing additional feeder buses to additional employment centers. These are discussed in Chapter 5C.

Employment locations near the Route 128 corridor that currently have bus connections to commuter rail or rapid transit stations include:

- Employment centers in Woburn (to Anderson RTC)
- Industrial and office parks on both sides of Route 128 in Waltham (to Waltham Station)
- Employment areas in Westwood and Norwood (to Route 128 Station)
- Centennial Park in Peabody (to Lynn Station)
- Square One Mall in Saugus (to Lynn and Malden Stations)
- South Shore Mall in Braintree (to Quincy Center and Braintree Stations)
- Business centers in Burlington and Bedford (to Alewife Station)

Employment locations in the I-495 corridor that have such connections are:

- Employment areas in Hopkinton and Milford (to Southborough Station)
- Solomon Pond Mall in Marlborough (to Framingham Station)

One of the important pieces of information that will be derived from the 2000 U.S. census, once the data are available in mid-2003, is how commuting patterns have changed in the past decade. Figures from the 1990 U.S. census showed that 83% of employed Boston residents worked either in Boston or in one of the ten surrounding municipalities with rapid transit and light rail service. Nine of the ten municipalities are within 15 rail miles of downtown Boston. Only 11% of employed Boston residents worked in cities or towns now served directly by commuter rail but not rapid transit and light rail. On average, only 3% of the workers employed in those cities and towns lived in Boston. In absolute terms, these municipalities were the work locations of 29,200 Boston residents out of 276,300 who worked anywhere in 1990.

The largest reverse commuting attractions for Boston residents are, and will likely continue to be, those within about 15 miles of downtown Boston. In most cases, better transit access to these destinations could be provided via express buses or a combination of rapid transit

and feeder buses than via commuter rail. Cities and towns with existing regional transit authority bus service, or other community-based bus service may also be able to modify routes and schedules to provide improved reverse commuting connections from commuter rail stations at relatively little cost.

Access to Service

Park-and-Ride Facilities

A major constraint within the MBTA system is the number of parking spaces at park-and-ride facilities and the limited amount of space available to expand these facilities.

At Commuter Rail Stations

There are 76 commuter rail stations within the Boston region that have parking facilities. These lots charge between $2 and $4 per day. There is a wide variance in the vehicle capacity of the commuter rail lots. Route 128 Station can currently hold 2,100 vehicles. Pride's Crossing, Plimptonville, and Silver Hill Stations each have spaces for fewer than 10 vehicles. The total number of spaces available at commuter rail stations in 2002 was 30,889.

Of the 76 commuter rail park-and-ride lots, 62 were considered to be at capacity in 2002. The MBTA considers parking facilities to be at capacity when they are over 85% full. Most of the lots that were below capacity were smaller ones: facilities with capacities of under 100 vehicles. The lone exception was Lynn, where the 965-vehicle facility (the commuter rail system's third largest) was observed to be only 38% full. The excess space in Lynn is partly due to its location in an urban downtown that is not well served by the highway network.

Another problem is the early time of morning at which many of these lots reach capacity. Although no studies have focused primarily on this situation, there is evidence that travel schedules and even work hours have to be shifted in order for commuters to arrive at commuter rail stations early enough to secure a parking space. Limited parking results not only in commuters being forced to drive into Boston on particular occasions when they find a commuter rail lot to be full, but also in some commuters making long-term decisions to forgo transit altogether due to the uncertain availability of parking.

Several projects have been built or are being planned to help remedy the parking shortage. Most recently, the largest parking project was the construction of the Anderson Regional Transportation Center. This new station has a parking capacity of 2,400 vehicles, with some of this capacity being reserved for patrons of Logan Express bus service. The expansion of Route 128 Station resulted in a total of 2,750 spaces, 550 of which are still reserved for long-term or Amtrak parking. The addition of three new stations in 2002 between Framingham and Worcester on the Framingham/Worcester Line increased parking by 1,150 vehicles. Other parking expansion projects will add approximately 1,000 more spaces of parking.

Park-and-ride lot–Riverside Station

It is projected that even with these new additions, the majority of the commuter rail network's park-and-ride lots will continue to be at or above capacity. This problem is compounded by the increased difficulty of locating and acquiring additional land around existing sta-

tions for parking expansion. Many stations are located in town or city centers where vacant land for expansion is scarce. Stations that are located outside of busy commercial districts are now attracting development themselves, complicating the expansion of these sites as well. Others are bounded by protected wetlands. It is also becoming increasingly difficult politically to expand existing stations, as the areas around many stations are impacted by commuter rail–related traffic that originates outside the town hosting the facility. Cost is another concern for the MBTA. The cost for each additional parking space ranges from $5,000 to $20,000. This figure does not include the cost of land acquisition.

Bicycle rack

At Rapid Transit Stations

The MBTA's rapid transit system is the location of another 29 park-and-ride lots. Ten of these are on the light rail system (Green Line and Mattapan High Speed Line), and the rest are on the three heavy rail lines. Parking charges at rapid transit stations are typically between $2.50 and $3.50; Alewife Station is $4.50. The two largest parking facilities are on the Red Line. They are Quincy Adams (2,378 spaces) and Alewife (2,515 spaces). The total number of spaces on the rapid transit system is 18,060.

All of the rapid transit parking facilities were considered in 2002 to be at capacity by the MBTA's 85% standard, with the exception of the three Mattapan High Speed Line stations. These three stations— Butler, Mattapan, and Milton—account for only 317 spaces. Since almost all of the MBTA's rapid transit stations are in dense urban areas, the difficulties of expanding parking are even more acute there than for the commuter rail system. There are currently no significant parking expansion projects underway or planned for the rapid transit system.

Bicycle and Pedestrian Access

Over the last several years, the MBTA has made significant progress in enhancing its Bikes-on-the-T program. The MBTA has worked on numerous aspects of the program to expand accessibility to the system for bicyclists. The following list details system improvements to date, as well as areas of continued effort:

- The MBTA has strengthened its relationship with Massachusetts Bicycle Coalition (MassBike) through creation of a formal advisory committee that works with the MBTA to address all bicycle accessibility issues related to its transit services. On this committee, the MBTA has included representatives from several departments, including Capital Planning, Railroad Operations, and Service Planning, as well as a representative from the Executive Office of Transportation and Construction (EOTC).
- The MBTA participates as an advocate of the bicycling community at special events such as the Statewide Bicycle/Pedestrian Conference. The MBTA served as a panelist at that conference.
- The MBTA has actively worked with community bicycle committees to develop master plans that promote transit and bicycle use. In 2001, the MBTA participated (along with MassHighway and EOTC) in the development of Boston's Bicycle Plan,

and it has consulted with communities on requests to develop better bicycle paths, station facilities, etc.

- The MBTA works with the Commonwealth's regional transit authorities to support development and operation of bicycle-accessible services to intermodal transportation centers in key cities including Brockton, Fitchburg, Lawrence, Lowell, Woburn, and Worcester. These services will permit bicyclists to access places of employment, residence, and recreation.

System Access Improvements for Bicyclists

- The MBTA has eliminated its bicycle permit program. This change has enhanced system access, trip mode flexibility, and customer satisfaction.
- The MBTA has expanded and enhanced its information on bicycle use systemwide through improved data collection efforts. Survey work targeting transit riders has been modified to include bicyclists and questions pertaining to the use of bicycles. In 2001, CTPS published useful bicycle transportation survey data collected in an EOTC-funded 2000 MBTA water transportation passenger survey.
- MBTA policy has been amended to allow folding bicycles on the commuter rail system at all times, without peak-period restrictions. A similar policy is under evaluation for the subway system.
- The MBTA has installed bicycle racks on buses assigned to crosstown routes and, in concert with MassBike, is considering rack installations on other bus routes. Options include retrofitting existing buses or including racks as a specification in future bus purchases.

Bicycle Parking Improvements

- The MBTA has instituted a capital program to expand bicycle parking facilities systemwide. This program dedicates transit enhancement funding in the amount of $50,000. The MBTA has worked with the MassBike to identify locations for bicycle racks. The MBTA has also installed bicycle parking at stations as part of its station modernization program.

Bicycle-Related Marketing Initiatives

- In conjunction with several of the above service improvements, the MBTA produced a new brochure to promote the Bikes-on-the-T program. These brochures have been distributed at various MBTA events.
- The MBTA and MassBike have developed a sign for stations to describe the Bikes-on-the-T program and its rules. This sign will also help to advertise the program.
- The MBTA's comprehensive system map now shows which stations have bicycle parking.
- Creation of an EOTC-funded, MBTA-designed water transportation Web site, www.massferryroutes.com, promoting this system's accessibility for bicyclists.

Pedestrian Access

Pedestrian access is also considered in the design or reconstruction of stations. Existing stations built before World War II are typically found to be within walking distance of a neighborhood or downtown area. In many cases, pedestrian access is better than automobile access. In suburbs with newly constructed stations, the automobile is generally the primary mode of access; however sidewalks are usually included in the design and connect to existing sidewalks within the community.

Progress of Legal Commitments since the 1994 PMT

To meet various state and federal mandates, the Commonwealth has committed to several projects and initiatives over the past twenty years.

In particular, the Commonwealth has pursued transit as a way to answer the requirements associated with the State Implementation Plan (SIP) for the Clean Air Act and the mitigation required by environmental agencies (pursuant to 310 CMR 7.36 and 310 CMR 7.38) to allow for the permitting of the Central Artery/Tunnel (CA/T) Project. As mentioned previously, the project screening process for the PMT included legal commitments as a criteria for ideas to undergo further analysis. By evaluating and prioritizing these commitments within the PMT, these projects continue to be eligible for programming within the CIP.

To date, the MBTA has played an active role in the implementation of many such commitments. Since 1994, many of the legal commitments have been completed, and many are in the process of being completed. In 2000, the Executive Office of Transportation and Construction (EOTC) and the Department of Environmental Protection (DEP) signed an Administrative Consent Order (ACO) related to the CA/T Project that established additional legal commitments. (In 2001, the ACO was amended to provide further clarity for some of these commitments.) Table 2-2 shows the status of legally-committed projects.

TABLE 2-2
STATUS OF SIP AND CA/T PROJECTS*

COMPLETED PROJECTS

Project	SIP Commitment	CA/T Commitment	ACO Commitment
Newburyport Commuter Rail Extension	Yes	Yes	No
Service to Worcester Commuter Rail Extension	Yes	Yes	No
Interim Worcester Stations	No	No	Yes
Washington Street Replacement Service	No	Yes	Yes
400 New Buses	No	Yes	No
20,000 Additional Parking Spaces	Yes	Yes	Yes
Old Colony Commuter Rail Restoration– Middleborough/Kingston	Yes	Yes	No
Bus Retrofits	No	No	Yes

PROJECTS UNDERWAY

Project	SIP Commitment	CA/T Commitment	ACO Commitment	Status
Old Colony Commuter Rail Restoration– Greenbush	Yes	Yes	Yes	Design and permitting ongoing
Red Line – Blue Line Connector	Yes	Yes	Yes	In planning stages
Blue Line Station Platform 6 Car Trains	Yes	Yes	Yes	Under construction
Green Line Extension to Tufts (Medford Hillside)	Yes	Yes	Yes	In planning stages
Green Line Arborway Restoration	Yes	Yes	Yes	In planning stages
New Orange Line Vehicles	No	Yes	No	In planning stages
South Boston Piers Transitway	Yes	Yes	Yes	Under construction
2 Commuter Boat Facilities	No	Yes	No	In planning stages
Alternative Fuel Bus Purchases (358 CNG Buses)	No	No	Yes	Purchase orders issued
Orange Line Signal Improvements	No	No	Yes	In planning stages
Service to T.F. Green Airport	No	No	Yes	In planning stages (RIDOT)
Silver Line Phase III	No	No	Yes	

**SIP:* *State Implementation Plan for the Clean Air Act*
CA/T: *Central Artery/Tunnel Project*

CHAPTER 3

Mobility Challenges for the 21st Century

Changes in demographics, growth patterns, and commuting behavior bring new demands to the Boston region's transportation system. The transit infrastructure of that system, in large measure planned and developed a century ago, is one of the nation's most extensive. It was designed as a hub-and-spoke system with the various rail line corridor spokes leading to the urban center. Boston today remains the region's economic and cultural center, but decades of dispersed development, population shifts, declining household size, and increasing automobile usage pose challenges for transit operation. The city of Boston now has two-thirds of the population it had in 1950, and many of its suburban communities require large minimum lot sizes for single family dwellings.

A transit system originally designed to move people efficiently into and around the fourteen communities of the urban core is now called on to supply multimodal travel options for residents of eastern and central Massachusetts. Transit service is a critical component of smart growth strategies aimed at forestalling sprawl and spurring revitalization of urban areas. Its efficient operations play a central role in regional efforts to maintain healthy air quality standards and to relieve highway traffic congestion, an increasing detriment to urban and suburban quality of life. Finally, decisions about where transit investments take place have socioeconomic impacts as well. All of these consequences speak to the need for coordinated and comprehensive planning.

To meet this array of challenges requires that the region address the MBTA's significant system capacity issues.

POPULATION GROWTH

The MBTA district is made up of 175 communities with a total population, according to the 2000 U.S. Census, of 4.7 million people. Almost three-quarters of all Massachusetts citizens reside within the MBTA service area. The district's communities include urban centers, mature suburbs, high-growth suburbs, and rural exurbs. Regional population grew at a moderate 6.07% rate during the 1990s.

Stability in the eastern Massachusetts population numbers, however, masks significant growth shifts within the region. High growth—exceeding 25%—took place along the Route 495 corridor in communities such as Franklin, Hopkinton, Mansfield, Southborough, Tyngsborough, Westborough, Groton, Westford, Norton, Lakeville, and Medway. Land availability and housing at costs more affordable than those found in the inner suburbs drove high growth in these once rural towns.

Meanwhile, many mature suburbs closer to Boston experienced low growth or, in the case of communities such as Arlington, Belmont, Dedham, Burlington, Medford, Melrose, and Watertown, actually lost population during the 1990s. Aging populations, declining household size, diminished supply of available land for development, and escalating home prices contributed to the lack of population growth in these communities.

MBTA commuter parking—Needham Junction Station

In 1950, more than 800,000 people lived in the City of Boston, or nearly one in every four residents of the present MBTA district. Over succeeding decades, with suburbanization aided by development of the interstate highway system, Boston experienced a population decline to 563,000 residents by 1980. Jobs and people migrated to the suburbs. Since 1980, the population has stabilized, for reasons including new immigrant growth and urban core revitalization. The city experienced population growth exceeding 2% in both the 1980s and 1990s, a turnaround from the average 11% population loss that took place in each of the three preceding decades.

By 2000, Boston's population accounted for about one in eight residents of the 175-community total.

ECONOMIC GROWTH

The Boston region is one of the most economically vibrant areas in the country. While the population increased by about 10% from 1970 to 2000, the number of jobs in the region increased over the same period by 44%. In the last decade, the 175 communities within the MBTA district reported robust job growth of 12.6%.

Economic growth and change is most pronounced in the Route 495 belt, where the job base expanded at rates more than three times the region's average. In the high-growth communities of Franklin and Westford, employment more than doubled between 1990 and 2000.

Within the 14 inner core communities of the MBTA district, the employment base increased by 8% during the 1990s, from 831,481 jobs in 1990 to 898,060 in 2000. The 64 inner ring suburban communities experienced 10.5% job growth. The 97 outer ring communities had 20% job growth in that same decade and by 2000 could claim total employment almost equal to that of the inner core communities (1990 employment—723,559; 2000 employment—864,680).

Together, these demographic changes have impacted commuting trends within eastern Massachusetts and have strained the overall transportation system.

COMMUTING PATTERNS

Highway Congestion

Traffic congestion on most of the major highways in the region has increased significantly during the past twenty-five years. Highway capacity is generally considered to be 2,000 vehicles per lane per hour, with congestion occurring when volumes exceed 1,750 vehicles per lane per hour. Because traffic is never distributed uniformly over 24 hours, practical daily capacity is defined as 20,000 vehicles per lane. In 1977, the only Greater Boston highways with daily volumes in excess of practical capacity were the Southeast Expressway, the Central Artery, and I-93 south between Route 24 and I-95. By 1997, other highways with daily traffic exceeding capacity included most of Route 128 from Canton on the south to Danvers on the north, most of I-93 within the state, Route 3 North from Route 128 almost to the New Hampshire border, Route 3 South from Braintree to Hanover, Route 1 North from Revere to Route 128, Route 2 from Concord to Route 128, the Massachusetts Turnpike from Natick to Newton Corner, and Route 24 from Stoughton to I-93. Several other major highways that had daily volumes well below capacity in 1977 were rapidly approaching capacity by 1997. These included I-95 South from Route 128 to the state line, Route 3 South from Hanover to Plymouth, Route 24 from Stoughton to West Bridgewater, the Massachusetts Turnpike from Newton Corner to Boston and from Framingham to Natick, and I-495 from Haverhill to Milford.

MBTA bus–Park Street Station

Highways that are classified as over capacity on a daily basis are free-flowing during some hours. Conversely, highways that carry traffic at lower than daily capacity levels can be congested at some times of day. In 1997, the most severely congested highway in the region was the Central Artery, segments of which showed congestion for over six hours in the morning and over eight hours in the afternoon and evening.

The corridors served by most of the radial highways that are close to or over practical capacity are also served by MBTA commuter rail or rapid transit lines. As discussed below, these parallel transit lines have either excess capacity or the potential to provide improved frequency. Transit alternatives in the circumferential highway corridors (principally Routes 128 and I-495) present greater challenges. Without exclusive lanes, transit vehicles using these highways would be subject to the same delays as other traffic. Converting existing lanes to transit lanes would increase congestion in the other lanes, and in any case it would be impossible to offer bus routes suitable for the travel needs of the majority of auto users. The cost of adding new exclusive transit lanes would be prohibitive. Parallel rail lines exist only in a few scattered locations in these corridors.

Capacity Issues on the Transit System

Vehicles

Rapid Transit

At present, passenger crowding on MBTA rapid transit vehicles occurs mostly during spans of one hour or less within A.M. and P.M. peak commuting times. Under MBTA service standards, the maximum load per vehicle during peak hours should not exceed a specified percentage of the seating capacity. This per-

centage varies among services depending on vehicle configuration. Demand is not uniformly distributed over the course of any hour, so it is possible for individual trips to be overcrowded even if the average hourly load is within the standard. It should also be noted that these crowding standards assume substantial numbers of standees, so many customers may perceive crowding with lighter loads.

Rapid transit station entry and exit counts conducted in 1997 contained sufficient information for calculations of ridership volumes on each line segment for each train on a typical weekday. The crowding conditions by line stated below are those that would have occurred if all scheduled peak-period trips were operated, and if each passenger took the first train departing the boarding point after the passenger arrived on the platform. In reality, some passengers would have waited for a less crowded train even if the load on the first one was within the service standard.

It is important for trains to run at or close to their scheduled intervals on all lines in order to prevent crowding from being more severe than indicated by the figures below. For example, the peak-period scheduled headway on the Blue Line is 3.5 minutes. If several successive trips normally have peak loads slightly over half the maximum standard when operating on schedule, a delay in service that creates a gap of 7.0 minutes will result in a load above the maximum standard on the next train. After that, one or more trains may follow at intervals of less than 3.5 minutes, and carry unusually low loads.

The peak load points referred to below are the segments where the 1997 count results indicated that passenger loads were highest on all or most trains during the time periods under discussion. In many cases, loads on other nearby segments were only slightly lower.

In 1997 the Blue Line had the highest incidence of overcrowding among the rapid transit lines. (This was a result of the lower capacities of Blue Line trains, as the other lines carried higher total volumes.) During the busiest 45 minutes in the A.M. peak, with service running on schedule, 60% of trains had more riders than the maximum standard at the peak load point between Maverick and Aquarium stations. Ridership was more dispersed in the P.M. peak, but 30% of trains in the busiest 45 minutes were overcrowded at the peak point. Plans are underway to increase the length of Blue Line trains from four to six cars. This would eliminate overcrowding with present train frequency even with a substantial ridership increase.

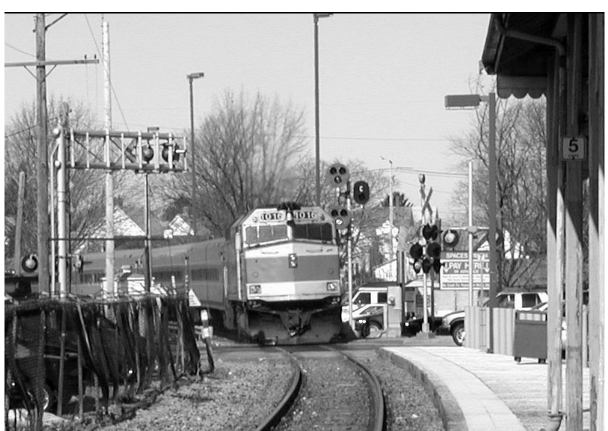
Red Line–Savin Hill Station

On the Orange Line's north-of-downtown section, maximum A.M. peak loads in 1997 occurred on southbound trains between North Station and Haymarket. During the busiest 45 minutes, 30% of these trains were overcrowded when service ran on schedule. In the P.M. peak, 10% of northbound trains in the busiest 45 minutes were overcrowded at the peak point. All trains on the south-of-downtown section of the Orange Line had loads within the crowding standard. Orange Line trains are already at the practical limit of six cars, so increased capacity would require shorter headways.

On the south-of-downtown section of the Red Line, maximum A.M. peak loads in 1997 occurred on northbound trains between

Broadway and South Station. Among trains originating on the Braintree Branch, 27% had peak loads close to but not above the crowding standard during the busiest hour if service ran on schedule. No trains originating at Ashmont exceeds the crowding standard. In the busiest 45 minutes in the P.M. peak, 20% of southbound Braintree trains were close to or over the crowding standard at the peak load point, but no Ashmont trains were. On the north-of-Boston section of the Red Line no trains exceeded the crowding standard during either the A.M. or P.M. peak. Red Line trains are already at the practical limit of six cars, so increased capacity would require shorter headways.

In the Green Line Central Subway, the maximum load point during A.M. peak hours in 1997 was entering Copley Station inbound. During the busiest 45 minutes, 25% of B Line trains, 38% of C Line trains, and 40% of D line trains had loads above the crowding standard there when all scheduled trips were run. No E Line trains were overcrowded. During P.M. peak hours the maximum load point was between Arlington and Copley stations. During the busiest 45 minutes, 10% to 25% of the trains on the B,C, and D lines had peak loads above the crowding standard but no E Line trains did. When these counts were conducted, all peak-period trips were run with two-car trains. Three-car trains are now run on some D Line trips when equipment is available.



Commuter rail–Stoughton Station

Bus/Trackless Trolley

MBTA bus routes in the urban core are subject to crowded conditions, especially in the peak periods and during school commute times. High-frequency bus routes with numerous crowded trips include: Route 15 Kane Square–Ruggles; Route 23, Ashmont–Ruggles; Route 28, Mattapan– Ruggles; Route 32, Wolcott Square–Forest Hills; Route 39, Forest Hills–Back Bay Station; Route 77, Arlington Heights–Harvard; and Route 111, Woodlawn (Chelsea)–Haymarket.

Standard-size urban transit buses have total seating capacity in the 39- to 43-passenger range, and are designed to accommodate 15–20 standing passengers. Crowding on peak trips can result in excessive standees or passengers unable to board a vehicle which is at maximum capacity. Improving frequencies in high-demand periods or using larger, articulated (two- section) buses would provide more capacity.

Buses on routes operating in heavy traffic conditions can be vulnerable to delays. These delays can result in long gaps in service and, especially if the route has a high frequency, bus bunching. Improving bus communication systems and installing signal priority equipment for buses could result in improved schedule adherence and reliability, and less crowding resulting from unscheduled gaps in service.

Commuter Rail

Capacities of MBTA commuter rail trains vary according to the number of cars and the mix of car types in the train. Until recently, service standards called for peak loads no greater than the number of seats. Peak-load-point counts conducted in 2000 found that no North Side trains had more riders than seats, but some passengers stood though they did not have to. On the South Side system, only the Fairmount and Needham Lines had no trains with more riders than seats in either

peak period. The Framingham and Franklin Lines each had at least one train with more riders than seats in the A.M. peak but none in the P.M. peak. The Attleboro/Stoughton, Middleborough/ Lakeville, and Plymouth/ Kingston Lines all had at least one train in each peak with a maximum load above seating capacity.

The capacity of MBTA commuter rail and rapid transit lines is limited not only by the capacity of the trains themselves, but also by the capacities of the modes used to access the trains. For commuter rail lines especially, adequate parking capacity is essential to diverting trips from private autos.

Facilities

Capacity issues at MBTA facilities must be addressed to meet future ridership demand before the Authority can play a more significant role in the region's mobility challenges. Forecasts estimate that overall MBTA ridership will grow by 32% between now and 2025. MBTA commuter rail ridership is predicted to rise by 45% during the same time period. These numbers, when combined with the crowding problems described above, suggest that capacity problems will be significant in the commuter rail system. Commuter rail system capacity is also limited by the throughput capacities of the downtown Boston terminal stations, as discussed below. They limit the times at which additional trips could be run on existing routes or on new extensions.

South Station is the Boston terminal for all MBTA South Side commuter rail lines and for Amtrak Northeast Corridor, Inland Route, and Chicago intercity service. North Station is the Boston terminal for all MBTA North Side commuter rail lines and for Amtrak Downeaster service from Maine. Both terminals currently have many fewer tracks than they originally did. South Station now has 13 tracks and North Station has 10. At times during peak commuting hours all tracks at South Station are occupied. North Station reaches 80% of capacity during the P.M. peak period. The problems associated with limited track space are compounded by the substantial expansion of commuter rail service over the last twenty years. Available time slots for tracks do not necessarily coincide with times at which demand for added service is greatest.

Expansion of South Station would involve reacquiring the sites of former tracks and platforms on the east side that are currently occupied by the U.S. Postal Service's General Mail Facility (formerly called the South Postal Annex). Increasing track capacity is necessary for any future expansion of South Side service. The MBTA also must site a new layover facility for commuter rail service on the South Side, since it will soon lose its existing storage location in Readville. Expansion of North Station would involve reacquiring the sites of former tracks and platforms on the west side that are currently occupied by a privately owned parking lot.

The capacity of the terminal stations also impacts the amount of yard capacity needed for midday or overnight storage of trains. When a platform must be vacated to make room for a subsequent train arrival, the departing equipment must either be used on an outbound revenue trip or sent to a yard in non-revenue service. Running either non-revenue trips or revenue trips at times when there is low demand increases daily operating costs. As in the case of the terminal stations, the capacity of rail yards in Boston has decreased significantly compared with historic peaks. Siting of new yards is difficult anywhere, but especially so near downtown Boston because of competition with other land uses. These issues must be taken into consideration in the operating plans for any expansion of commuter rail service.

The changing demographics of the region indicate the need for more transportation opportunities in eastern Massachusetts. The transporta-

tion network currently faces significant capacity challenges. For the MBTA to play its role in providing greater mobility for residents, capacity-building projects must address the limitations of the existing transit system.

Projected Transit Projects from Regional Transportation Plan

As explained in Chapter 1, the PMT is closely linked to the Boston MPO's 2000–2025 Regional Transportation Plan (RTP), which is also a long-range planning document but is multimodal in nature. While transit improvements identified in future RTPs will be informed by this PMT, it is useful to note that the existing RTP already recommends some transit expansion projects for eventual implementation. Unlike the PMT, the RTP is constrained by assumed funding availability. The RTP allocates 70% of transit funds to infrastructure maintenance, accessibility improvements, and system enhancements. The remaining 30% is allocated to system expansion. The amount of money available for transit system expansion from the present through the year 2025 is assumed to be $2.36 billion from local sources and $875 million from federal funds, making a combined total of $3.23 billion.

With this assumed funding limit, only eleven transit expansion projects were included in the Regional Transportation Plan's list:

- Green Line restoration between Heath Street and Arborway
- 100 additional buses to improve service on existing routes
- Fairmount commuter rail line improvements
- Red Line–Blue Line connector
- Russia Wharf Ferry Terminal
- Silver Line Phase 3
- New Bedford/Fall River commuter rail extension
- Old Colony Greenbush Branch commuter rail extension
- Medford Hillside Green Line extension
- Urban Ring Phase 1
- Assembly Square Orange Line station

CHAPTER 4

Financing Strategies

The Program for Mass Transportation is financially unconstrained and encompasses various projects for which the sources of funding are as yet unidentified. Such sources are limited, however, due to the Commonwealth's legal commitments to the State Implementation Plan for the Clean Air Act and the Central Artery/Tunnel Project mitigation program. In an attempt to fund some of the unfunded projects, the Authority has entertained various innovative financing strategies to supplement more traditional funding sources.

TRADITIONAL FUNDING SOURCES

Operating

The recently enacted fiscal reform legislation substantially altered the Authority's funding environment. The new Enabling Act established dedicated sources of revenue and mandated that the Authority is to operate as an independent, financially self-sustaining public transportation agency. Previously, the Commonwealth had funded the MBTA in arrears. The Enabling Act and the new financing mechanism for the MBTA have been referred to as Forward Funding, to reflect the fact that the MBTA's costs will no longer be funded in arrears.

Commencing July 1, 2000, the Authority no longer received net-cost-of-service or debt assistance. Instead, under the Enabling Act, the Authority receives a dedicated revenue stream consisting of assessments paid by the 175 cities and towns in accordance with the Enabling Act and the greater of (1) the amount raised by a 1% statewide sales tax, which equals 20% of the existing statewide 5% sales tax, or (2) $645,000,000, in either case to be funded from existing sales tax receipts, subject to upward adjustment under certain circumstances set forth in the Enabling Act.

In addition to the dedicated revenues, the Authority's operations are funded by fare revenue and nonfare revenue, such as revenue from advertising, parking, concessions, and real estate sales, and interest income. The Authority has experienced a decline in both fare and

sales tax revenues. Growth in sales tax revenues is expected to remain flat in fiscal year 2003, with the MBTA receiving the guaranteed floor amount. Additionally, the floor amount will not increase in fiscal year 2004.

Capital

The MBTA's capital program is primarily funded by four major sources: revenue bonds, pay-as-you-go capital, federal grants, and project financing. Prior to Forward Funding, the MBTA's nonfederal portion of the capital program was funded by General Transportation System bonds issued by the MBTA and backed by the Commonwealth Guaranty. Under Forward Funding, it is primarily funded in the early years by revenue bonds secured by the dedicated revenues under two separate credits established under the Enabling Act: assessment bonds and sales tax bonds. The assessment bonds are secured by the assessments paid by the 175 cities and towns in the MBTA district and the sales tax bonds are secured by the sales tax revenues received by the Authority. The MBTA sales tax and assessment credits are further enhanced by a cross collateralization that exists for additional security.

The MBTA's goal is to preserve sufficient funding for the operating budget, and it cannot allow debt service expenses to increase in relation to operating expenses. Taking this into consideration, the MBTA will look to transition itself from heavy reliance on debt financing to greater use of pay-as-you-go financing of capital projects. The transition from debt financing to pay-as-you-go will take time and discipline, and it depends, to some extent, on factors beyond the MBTA's control, such as ridership, the growth in future sales tax collections, and cost containment.

Federal Funding

The MBTA receives funding from several different federal programs:

- Section 5307 Urbanized Formula Funds.
- Section 5309 Rail Modernization Formula Funds.
- Section 5309 Bus Discretionary Funds.
- Section 5309 ("New Starts") grants. The Federal Transit Administration's Section 5309 program is highly competitive nationwide and involves an application process in which the project must be justified based on forecasted impacts on mobility and the environment, operating efficiencies, cost-effectiveness, and land use. The application must also include a reasonable plan to finance the proposed project.
- Transportation Infrastructure Finance and Innovation Act (TIFIA): This act established a new federal credit program under which the U.S. Department of Transportation may provide federal credit assistance to major transportation investments of critical or national significance.

SOME NATIONAL EXAMPLES OF TIFIA PROJECTS

Project	Location
State Route 125 South	San Diego County, California
Washington Metropolitan Area Transit Authority Capital Improvement Program	District of Columbia, Maryland, Virginia
Miami Intermodal Center	Miami, Florida
Reno Transportation Rail Access Corridor	Reno, Nevada
Farley Penn Station	New York City, New York
Staten Island Ferries and Terminals	New York City, New York
Tren Urbano	San Juan, Puerto Rico
Cooper River Bridge	Charleston, South Carolina
Central Texas Turnpike	Austin–San Antonio Corridor, Texas
Tacoma Narrows Bridge	Tacoma, Washington

The TIFIA program is designed to fill market gaps and leverage substantial private co-investment by providing supplemental and subordinate capital and credit.

- Grant Anticipation Notes (GANs): GANs are short-term debt instruments that are secured by future federal grants, which will be received after the debt is issued. Financial institutions may buy anticipation notes on behalf of project sponsors in advance of receiving other financial assistance, to make possible a faster project start. This is an innovative financing tool that will allow the MBTA to leverage future federal funds.

  Example: The MBTA is currently using GAN financing to accelerate the procurement of 175 emission-control buses.

The combination of these funding sources supports the MBTA's current operating budget of $1.2 billion and capital budget of $2.6 billion for fiscal years 2003–07.

INNOVATIVE FUNDING

Innovative financing is a critical element of project implementation. This often determines the project's ability to receive the necessary funding and has an impact on the project moving forward within the region's planning process. As a project advances from the PMT into other elements of the planning process, financial constraints are increasingly introduced that force regional decisions on priorities. In the current fiscal climate, a project that is partially or fully funded by innovative financing sources is more likely to be implemented.

Innovative sources of funding can be found at all levels of government, as well as in the private sector.

Local Funding Options

- *Tax Increment Financing (TIF):* TIF is a mechanism that is applied differently in Massachusetts than in other parts of the country. In the Commonwealth, TIFs offer developers tax incentives for their projects. Across the United States, TIFs are used to capture growing tax revenues that accrue from the increased property values produced by a specific transit investment by utilizing a portion to finance the transit investment.

- *Payment in Lieu of Taxes (Pilot):* This concept attempts to capture some revenue from tax-exempt institutions that receive a benefit from a new project.

  Example: This program is currently used in the cities of Boston and Cambridge to generate revenue to support services provided to institutions that are exempt from property taxes.

- *Joint Development:* This option would involve a partnership between the MBTA and municipalities to improve an existing transit asset.

  Example: Tri-Met (Portland, Oreg.) Airport MAX Red Line Expansion is a $125 million, 5.5-mile rail extension to the Portland International Airport terminal. The project was funded through Passenger Facility Charges, Urban Renewal funds, and contributions from Tri-Met and the builder/private developer. The builder/private developer contributed 20% of the total project cost in return for an 85-year lease on a nearby 120-acre site. The developer is undertaking a mixed-use, transit-oriented development.

- *Betterment Assessment District:* This alternative involves the imposition of a fee to a property within a certain catchment area. This concept could be applied to communi-

ties in a transit corridor where investment will occur to help pay for the transit investment. Because a betterment assessment is not technically considered a tax, it could be applied to both tax-exempt and taxable properties.

- *Impact Fee:* Impact fees could be introduced on developments within a certain catchment area along a transit corridor. These fees could help to support the transit investment in that area.

- *Parking Surcharge:* This alternative is a surcharge on parking spaces within certain catchment areas. These surcharges could be used to finance transit investments.

State Funding Options

- *General Obligation Bonds:* General obligation bonds are currently the bonds most commonly used by the Commonwealth to finance major public infrastructure projects. The full faith and credit of the state is pledged for the payment of principal and interest when due.

- *Highway-Flexed Funding:* This option flexes federal highway dollars to implement transit projects.

  Example: In federal fiscal year 2003, the Massachusetts Highway Department flexed $1.3 million in Congestion Mitigation and Air Quality Improvement Program (CMAQ) funds to the MBTA for its low-sulfur-fuel program.

- *Outside Sections in the State Budget:*

  - The state Legislature can provide funding assistance for projects through an earmark in the state's budget.

  Example: In 2002, the Legislature provided the option for debt service funding to construct the Fall River/New Bedford project.

  - *MBTA Infrastructure Fund:* The state may provide funding for the MBTA's infrastructure program by transferring funds from the General Account.

    Example: Red Line Station modernization.

Private Funding Options

- *Property Transfer:* The MBTA could enhance a given investment's financing by avoiding certain land acquisition costs through the transfer of MBTA property to private landholders. This situation could occur where specific, privately held property is needed to implement a particular transit project, and the MBTA can transfer a parcel to the private landholder in that area.

- *Station Sponsorship:* The MBTA would generate revenues from the naming rights associated with selected MBTA stations and use these proceeds to support transit improvements.

- *Private Employers Currently Financing Transit:* Private employers who currently run their own services may wish to instead invest in new MBTA service.

  Example: The Urban Ring Major Investment Study suggested that the operators of the twelve private shuttles (including Medical Academic and Scientific Community Organization, Inc., and University of Massachusetts at Boston) in the Urban Ring corridor could make payments to the MBTA for Urban Ring service instead of operating their own services.

- *MBTA-Promoted Development:* This alternative involves the MBTA's leveraging of its property holdings to generate funding for project implementation. This option could include the disposition of air rights or the sale/lease of property. This funding

source could be an important component of any transit-oriented development initiative.

- *63-20 Corporation:* A 63-20 Corporation is a private Massachusetts nonprofit entity organized for the limited purpose of taking the actions necessary to provide financing for a capital investment. This corporation would be exempt from federal income tax under Section 501(c)(3) of the tax code.

  Example: The MBTA funded the construction of the Route 128 Station parking facility by forming a 63-20 Corporation.

- *Project Financing:* This option involves the generation of funds to finance an economically separable capital investment project. It can be arranged when a facility or a set of assets is capable of functioning profitably as an economically independent unit. The providers of the funds look primarily to the cash flow from the project as the source of funds to service their loans.

Multijurisdictional Funding

A number of projects within the PMT would require significant coordination between various jurisdictional entities. In particular, the North-South Rail Link and the commuter rail extensions into New Hampshire and Rhode Island would need agreements between state governments to secure adequate funding for these projects. Projects within the MBTA service area may also rely on multijurisdictional financing for implementation. A recent example of a successful state project is the recently completed Anderson Regional Transportation Center in Woburn, where the MBTA, Massachusetts Highway Department, and Massachusetts Port Authority collaborated to construct this facility.

* * *

These innovative funding alternatives are described to provide an overview of possible financing strategies for PMT projects. These concepts were generated from projects that are currently being funding in Massachusetts and across the country. The MBTA and the Commonwealth will consider using all of these funding strategies to implement a balanced set of preservation and expansion projects.

CHAPTER 5A

System Preservation

The MBTA is responsible for maintaining an extensive network of transit infrastructure and other capital assets. The assets include:

- 275 stations
- Approximately 8,600 bus stops
- 100 elevators and 132 escalators
- 31,400 surface parking spaces and 10,600 garage spaces
- 19 miles of tunnel
- 560 bridges
- 36 maintenance facilities
- Approximately 785 miles of track
- More than 2,000 vehicles

The Authority has inventoried nearly 2,500 capital assets and has established a computer database that includes information on each asset's useful service life, age, operational impact, replacement/rehabilitation cost, and affected ridership. The Systemwide Condition Assessment and Capital Investment Program Database and Forecasting Model is a capital planning tool designed to document system infrastructure needs and priorities.

Analysis using the database indicates that over the course of the next twenty years with unlimited budget authority, the MBTA would need to spend more than $12.5 billion in current dollars to bring the system into a state of ideal repair. Table 5A-1 breaks this down into the costs of the high-, medium-, and low-priority system-preservation tasks. Sustaining the system at its existing level of performance will require an estimated annual capital expenditure of $470 million dedicated to system preservation.

TABLE 5A-1
SYSTEM PRESERVATION COSTS OVER THE NEXT TWENTY YEARS: A SUMMARY

	High-Priority Costs	Medium-Priority Costs	Low-Priority Costs	Total 20-Year Costs
TOTAL	**$2,663,700,643**	**$6,827,394,254**	**$3,161,665,006**	**$12,652,759,903**

REVENUE VEHICLES

The revenue vehicle fleet is one of the most visible and important components of the MBTA service network. The MBTA's fleet of revenue vehicles is composed of:

- 408 heavy rail rapid transit vehicles serving the Red, Orange, and Blue Lines
- 180 light rail vehicles serving the Green Line and Mattapan High Speed Line
- 377 commuter rail passenger coaches
- 80 commuter rail locomotive units
- 957 diesel motor bus coaches
- 17 compressed-natural-gas buses for the Silver Line
- 2 hybrid buses
- 40 electric trackless trolleys
- 426 RIDE vehicles
- 2 passenger ferries

The MBTA adheres to a general standard life-cycle of 35 years for heavy rail and light rail vehicles, 25 years for commuter rail locomotives, 25 to 30 years for commuter rail coaches, and 15 years for buses. The condition of each vehicle fleet is generally dependent on age. Several of the older fleets are currently in need of major component replacements, overhauls, or, in some cases, replacement. Without scheduled overhauls and planned retirements, maintaining the existing MBTA revenue fleet in operation and maintaining service reliability would require unwarranted consumption of resources.

Red Line

Table 5A-2, at the end of this section, gives projected costs for the preservation and replacement of revenue vehicles during the next twenty years.

Heavy Rail/Light Rail

- There are 218 Red Line cars made up of three separate series of cars: 74 No. 1 cars (acquired in 1969), 58 No. 2 cars (1988), and 86 No. 3 cars (1994). Preventative maintenance inspections are mileage based and occur every 8,500 miles for the No. 1 and No. 2 cars and every 10,000 miles for the No. 3 cars.

  Procurement of a new fleet to replace the No. 1 cars is anticipated between 2010 and 2014.
- The Blue Line fleet is comprised of 70 No. 4 cars (1979). The development of specifications for a replacement fleet was initiated in fiscal year 1999. A contract for 94 new Blue Line vehicles was awarded to Siemens Transportation in 2001. Preventative maintenance inspections are done on each car approximately once a month.
- The Orange Line fleet consists of 120 No. 12 series cars (1981). Preventative maintenance inspections are time-based and occur on a 90-day interval. Procurement of a new Orange Line fleet is anticipated between 2010 and 2014.
- There are 180 light rail vehicles (LRVs) comprising three separate series of cars: 55 Boeing LRVs (1976-83), 115 Type 7 cars (1986-88, 1997), and 10 PCC cars (1945-46). The first two series are used on the Green Line and the third series is used on the Mattapan High Speed Line, which has the oldest set of vehicles on MBTA proper-

ty. A rehabilitation program for the Mattapan PCC fleet to further extend the service life by 10 years is presently underway. The procurement of 100 Type 8 vehicles is currently funded and underway and will enable the retirement of the 55-car Boeing fleet, thus increasing the Green Line fleet by 45 vehicles. These new vehicles will be put into service over the next 3 years. Procurement of PCC replacement vehicles for the High Speed Line is anticipated to take place between 2010 and 2014.

Heavy rail rapid transit rolling stock generally has a useful life of 35 years or more. However, due to the salt-air environment of the Blue Line, its cars are not scheduled to have a useful life of more than 27 years. The MBTA subscribes to a philosophy of ongoing preventative maintenance for light rail and heavy rail vehicles. This approach keeps the vehicles safe and reliable at a reasonable cost. The Authority includes in its preventative maintenance program major components such as floors, pantographs, couplers, and overhead blower motors.

Commuter Rail

The commuter rail fleet consists of passenger coaches and locomotive units.

Coaches

There are 377 coaches, comprising four series:

- 57 Pullman Standard coaches (procured in 1979); this fleet was overhauled in 1995–96.
- 67 MBB coaches (1987–88).
- 146 Bombardier coaches (1987, 1989–90).
- 107 bi-level Kawasaki coaches (1990–91, 1997, 2002).

The MBTA is in the process of acquiring 24–28 additional bi-level coaches to meet the requirements of the Greenbush Line.

Silver Line

Future procurements to replace single-level coaches built in 1979, 1987-88, and 1989–90 will be bi-level equipment.

Locomotives

The revenue locomotive fleet is comprised of 80 units:

- 18 model F40PH-2 locomotives (procured in 1978, 1980); this fleet was upgraded in 1989–90.
- 25 model F40PH-2C locomotives (1987–88); a midlife overhaul was completed in 2002.
- 12 model F40PH-2M locomotives (1991, 1993); a midlife overhaul process began in 2002 and is ongoing.
- 25 model GP40-MC locomotives (1997–98).

Locomotives and coaches are typically considered to have a useful life of 25 years. Generally top-deck overhauls are scheduled for locomotives on a 6- to 6.5-year schedule. Mid-life overhauls are usually conducted at 12.5 years; they are designed to enable a vehicle to reach its full service life in terms of power, performance and dependability. Locomotives and coaches are typically replaced after a vehicle has met its 25-year life expectancy. Procurement of new locomotives to replace those built in 1978–80 is anticipated by 2005.

Silver Line

The MBTA is still constructing the new Silver Line, a bus rapid transit (BRT) system with service on Washington Street and the South Boston Piers Transitway. The new Silver Line service will provide connections between residential neighborhoods and job centers in the Financial District, and between South Station and the South Boston Seaport District. The service will also be coordinated with Massport to provide service to Logan Airport. Vehicle procurements have been made for Silver Line service on Washington Street (2002) and the South Boston Piers Transitway (2003). The vehicles are anticipated to have a useful life of 12 to 15 years. The introduction of the new fleets will entail additional operating funds for service and maintenance.

Bus

This program includes vehicles to support the MBTA's bus, trackless trolley, and demand-responsive (RIDE) services. The MBTA's bus and trackless trolley system is comprised of approximately 170 routes. THE RIDE, a paratransit service for individuals with mental or physical disabilities, provides accessible service in 62 cities and towns.

CNG bus

Bus Fleet

The bus fleet consists of 957 active diesel buses (of six major classifications), 17 compressed-natural-gas (CNG) buses, 2 diesel-electric hybrid buses, and 40 trackless trolley vehicles. The 40-foot diesel and CNG coaches have a useful life of 15 years, and the trackless trolleys have a useful life of 20 years. Major procurement efforts over the next few years will transition these vehicles to lower-emissions technologies.

Presently on order are 44 60-foot CNG buses (to be partially allocated to the Silver Line), 299 40-foot CNG buses, 28 40-foot electric trackless trolleys, and 175 low-emissions vehicles. By 2005, all vehicles built prior to 1994 will have been replaced. All of the new vehicles will feature easier-to-access low-floor designs, easier-to-read destination signs, and automatic stop-announcement equipment.

In addition, 426 RIDE vehicles are maintained under the bus program.

Present Fleet

2001 CNG New Flyer

This series comprises 15 40-foot CNG-powered low-floor buses procured in 2001. This equipment is currently in service on the Silver Line on a temporary basis prior to the arrival of new articulated buses.

1999 Future Bus Prototype

To determine the most appropriate technology for future-bus purchases, the Authority has undertaken a future bus pilot program. In the summer of 1999, the MBTA accepted the delivery of 2 New Flyer CNG buses and 2 Orion diesel-electric hybrid buses. Both bus types are 40 feet in length. The prototype program enabled a decision to be made on which bus propulsion technology to advance.

1995 Nova RTS

The newest and most recent diesel bus acquisitions of the MBTA are 149 coaches equipped with wheelchair lifts and air conditioning.

1994 TMC RTS

This series is comprised of 247 diesel coaches equipped with wheelchair lifts and air conditioning.

1989 TMC RTS

This series is comprised of 195 diesel coaches. Within this series, 30 coaches are 35 feet long, the only non-40-foot-length buses in the fleet. The buses are equipped with wheelchair lifts and air conditioning. These vehicles were rebuilt in 1996.

1985–87 GMC RTS

This fleet is made up of 366 diesel coaches. These buses were delivered in three distinct phases: 189 in 1985, 89 in 1986, and 88 in 1987. These 40-foot coaches had full midlife rebuilds in either 1994 or 1996.

Trackless Trolleys

The trackless trolley fleet includes 40 electric trolley buses (1976). The trackless trolleys have attained their service life expectancy and are in the process of being replaced. Service life for the new trackless trolleys remains to be confirmed; however, it is expected to be approximately 20 years.

THE RIDE

THE RIDE's fleet consists of 426 cars and vans that have a normal life span of 5 years. The MBTA owns 265 sedans and vans, and the remaining 161 vehicles are supplied by four different contractors. The Authority is moving toward a contracting program for all these vehicles. Those owned by the MBTA are not being replaced as they reach their service life expectancy.

Boat

The vessels owned by the MBTA are 2 82-foot high-speed diesel catamarans. The MBTA purchased these pre-owned vessels in 2002 from Water Transportation Alternatives, Inc.

NON-REVENUE EQUIPMENT

Non-revenue equipment includes both non-revenue vehicles and work equipment. Systemwide, non-revenue vehicles support the entire range of Authority operations. Included in this category are a wide array of rubber-tired vehicles that are used for maintenance, safety, field supervision, and revenue collection. The MBTA owns and maintains 858 non-revenue vehicles, including 479 vehicles to support

TABLE 5A-2
REVENUE VEHICLES
Preservation and Replacement Costs over the Next Twenty Years

	High-Priority Costs	Medium-Priority Costs	Low-Priority Costs	Total 20-Year Costs
Access (THE RIDE)	$3,866,561	$12,779,258	$6,389,629	$23,035,448
Bus	$341,980,697	$708,308,657	$169,276,761	$1,219,566,115
Silver Line (incl. South Boston)	$0	$70,520,560	$86,360,000	$156,880,560
Commuter Rail	$310,566,960	$1,428,601,680	$304,094,340	$2,043,262,980
Ferry	$158,400	$633,600	$3,294,720	$4,086,720
HR/LRV				
Blue Line	$288,320,560	$46,394,480	$0	$334,715,040
Green Line	$102,643,000	$34,353,000	$12,870,000	$149,866,000
Orange Line	$7,460,640	$534,900,960	$34,650,000	$577,011,600
Red Line	$10,791,000	$262,548,000	$234,927,000	$508,266,000
HR/LRV Total	$409,215,200	$878,196,440	$282,447,000	$1,569,858,640
TOTAL	$1,065,787,818	$3,099,040,195	$851,862,450	$5,016,690,463

heavy rail rapid transit/light rail and bus operations, 115 police vehicles, 219 vehicles to support commuter rail, and an additional 45 specialty vehicles such as fork trucks, sweepers, trailers, generators, and pumps. Non-revenue vehicles have a service life of approximately 10 years.

Non-revenue vehicles used to maintain commuter rail rights-of-way include rail-mounted or on-track machines such as track geometry cars, flat cars, cranes, tampers, ballast regulators, ballast cars, tie handlers, and brush cutters.

Categorized as "work equipment" are other brush cutters, as well as loaders, pumps, tractors, air compressors, and other equipment. Maintenance-of-way work equipment includes several types of trucks: crane, bucket, cable, platform, and snow-fighting. Rubber-tired construction work equipment includes front-end loaders, backhoes, and cranes. Work equipment has a service life of approximately 10 years.

Table 5A-3 gives projected costs for the preservation and replacement of non-revenue equipment during the next twenty years.

TRACK

Rapid Transit/Light Rail

The MBTA currently operates heavy rail rapid transit and light rail service over 185 miles of track. The commuter rail system is operated over 600 miles of track. On each rail line, replacement efforts are programmed for different segments based on geographical location or type of track construction.

The right-of-way generally consists of track, ballast, and concrete or timber ties. Track has a useful life of 25 years. Grade crossings have special maintenance and replacement needs, and are typically replaced as part of a stand-alone program.

- The Red Line (heavy rail) operates over 45 miles of revenue track. The types of track construction are timber tie, concrete dual block tie, direct fixation, and concrete floating slab. The entire line is powered by third rail.
- The Orange Line (heavy rail) operates over 22 miles of revenue track. The types of track construction are timber tie, direct fixation, and concrete floating slab. The entire line is powered by third rail.
- The Blue Line (heavy rail) operates over 12 miles of revenue track. Its primary track type is timber tie; however, sections of the track are monoblock concrete tie track. The line is powered by third rail and overhead catenary lines.
- The Green Line (light rail) has a total of 46 revenue track miles. Although the track type varies throughout the Green Line, the majority of the line is wood tie and ballast units; there is some monoblock concrete tie track as well. The running rail on the line consists of both "T" rail and girder guardrail. The entire line is powered by overhead catenary.

Heavy rail/light rail grade crossings have a useful life ranging from 12 to 15 years. There are 64 grade crossings along the Green Line and other crossings within MBTA yards. The heavy

TABLE 5A-3
NON-REVENUE EQUIPMENT
Preservation and Replacement Costs over the Next Twenty Years

	High-Priority Costs	Medium-Priority Costs	Low-Priority Costs	Total 20-Year Costs
TOTAL	**$39,817,699**	**$62,194,136**	**$44,027,475**	**$146,039,310**

rail/light rail fleets operate over 1 million feet of mainline-ballasted track and over 400,000 feet of yard-ballasted track. The MBTA has approximately 560 mainline turnouts (including equipment), which have useful lives ranging from 4 to 25 years. There are 675 total yard turnouts (including equipment) which have useful lives ranging from 8 to 25 years.

Commuter Rail

Commuter rail right-of-way consists of rail, wooden ties, railroad crossties, grade crossings, and fencing. The commuter rail system is divided into eleven major operating lines:

North Side—North Station Terminal

- The Fitchburg Line (90 miles of track)
- The Lowell Line (50 miles of track)
- The Haverhill Line (55 miles of track)
- The Newburyport/Rockport Line (92 miles of track)

South Side—South Station Terminal

- The Worcester Line (89 miles of track)
- The Needham Line (13 miles of track)
- The Franklin Line (34 miles of track)
- The Attleboro/Stoughton Line (116 miles of track)
- The Fairmount Line (19 miles of track)
- The Middleborough/Lakeville Line (approximately 47 miles of track).
- The Plymouth/Kingston Line (32 miles of track)

Rail in the commuter rail system can be expected to last approximately 40 years, although curve rail has a shorter life span. The system contains over 1,300 miles of rail. There are approximately 1.5 million timber crossties and switch timbers supporting the commuter rail system. Railroad crossties are renewed on a cyclical schedule that ensures that failed ties do not impose speed restrictions that result in train delays. Railroad crossties usually have a life span of 25 to 30 years, depending on a variety of mechanical and environmental factors. They also require a renewal of approximately 48,000 crossties and 5,000 switch timbers annually.

Track and signal

Grade crossings are the most prominent fixtures of the commuter rail system. The Authority has 257 grade crossings on the commuter rail system, requiring a replacement program averaging 21 crossings per year. They provide comfort and safety for both commuter rail passengers and highway motorists. Grade crossings have a life expectancy of 12 years. The automatic protection equipment is maintained under the signal program.

The majority of rail in the commuter rail network is welded rail. There are still sections of older, bolted rail on the Haverhill, Lowell, and Fitchburg Lines. The PMT process has identified replacement of older rail along the Fitchburg Line as a high priority.

As part of the PMT process, concerns were raised about track flooding issues at Natick Station and near the Boston Engine Terminal on the Fitchburg Line. Modifications to track and drainage structures in the area would be budgeted within the commuter rail track maintenance resource allocation.

TABLE 5A-4
TRACK
Preservation and Replacement Costs over the Next Twenty Years

	High-Priority Costs	Medium-Priority Costs	Low-Priority Costs	Total 20-Year Costs
Commuter Rail	$88,409,465	$1,018,975,938	$466,420,515	$1,573,805,918
HR/Light Rail	$68,475,514	$273,908,154	$136,954,077	$479,337,745
TOTAL	$156,884,979	$1,292,884,092	$603,374,592	$2,053,143,663

SIGNALS

Train control is an integral part of operating a transit system. The signal system's primary goal is maintaining train separation while attempting to minimize headways and run times. In order to maintain proper train separation principles for route integrity, speed control and broken rail protection are employed in the design. These signal system aspects are thoroughly tested as part of the installation process and require ongoing maintenance. The MBTA utilizes two basic types of signals: absolute block signaling (ABS) and automatic train control (ATC). The ABS system uses AC circuits and is applied on the Blue Line where train separation is maintained by the use of trip stops. On the Green Line, ABS is also used, but the operator has the sole responsibility for adhering to signal aspects. The ATC system uses audio frequency track circuits. This allows transmission of the maximum allowed speed to an intelligent carborne subsystem. Maximum allowed speed is determined by civil restrictions as well as track conditions and is enforced by the wayside signal system in conjunction with the carborne subsystem. The baseline for signal systems is the use of vital relays that operate in a "fail-safe" mode. This equipment is housed in central instrument rooms/houses and in wayside cases or bungalows. Signal control systems rely on relays, fuses, transformers, rectifiers, and resistors, as well as switches, signals, track circuits, heaters, train stops, and train approach lights.

Signal System Components (Shared by Commuter Rail and Heavy Rail/Light Rail)

Switches, Crossovers, and Switch Heaters

Switches and crossovers are incorporated into the track system to reroute trains. Both electric and hand-throw switches are used. Switch heaters are used to keep switches functioning during the winter months. Switches, crossovers, and switch heaters typically have a 5-year useful life.

Signals/Wayside Lights

Wayside lights display a combination of signal aspects to communicate the status of the next track segment to the train operator. They typically have a useful life of 2 years.

Track Circuits

The track circuit is the most vital part of the signal system and consists of a power source, a transformer or transmitter circuit, and a receiver or relay end. AC track circuits are used on the Blue and Green Lines as well as on all interlocking areas. Audio frequency track circuits, made up of a transmitter and receiver end, are used on the Red and Orange Lines. They have a 20-year useful life.

Grade Crossing Signals

Grade crossing signals are used on the commuter rail network to warn automobile drivers and pedestrians of oncoming trains. They have a useful life of 20 years.

Heavy Rail/Light Rail

The Authority's heavy rail/light rail signal program consists of the two control systems (ATC and ABS), varying by line. Each line consists of mainline and yard segments.

- The Red Line signal system consists of several yard and mainline segments. It is an ATC system, which means that it uses vehicle systems and wayside controls to regulate train movements. There are a total of 135 switches, 210 signals, 355 track circuits, 1,632 third-rail heaters, 68 switch heaters, 2 train stops, 2 train-stop heaters, 12 train-approach lights, and 16 instrument houses. Currently, the Authority is in the process of replacing generation-one track on the Red Line at Central Square, Downtown Crossing, JFK/UMass, Ashmont, and on the Braintree branch. The significant number of third-rail heaters is due to the large segment of the line that is above ground and exposed to the elements.
- The Orange Line utilizes a combination of ATC and wayside–block signal systems. It has a total of 107 switches, 199 signals, 245 track circuits, 457 third-rail heaters, 101 switch heaters, 34 train-stop heaters, 17 train stops, 48 train-approach lights, and 12 instrument houses. The signal system from Chinatown to Oak Grove is about 25 years old and is currently programmed for replacement.
- The Blue Line has a total of 86 switches, 154 signals, 181 track circuits, 12 third-rail heaters, 43 switch heaters, 145 trip stops (each with two heaters), 145 train stops, 74 train-approach lights, and 6 instrument houses. After completion of work on Airport and Aquarium Stations, there will be 2 additional instrument houses. The Blue Line is equipped with ABS (with train stops), and it does not utilize on-board subsystems for train movement.
- The Green Line signal system is the oldest in the United States, and the age of portions of it exceeds the industry standards for useful life. It is equipped with an ABS signal system, but without train stops. It has a total of 91 switches, 497 signals, 497 track circuits, and 40 switch heaters. Portions were upgraded following the flood of 1996, including the section from Brookline Village to Hynes Auditorium/ICA. The Haymarket-to-North Station section is being upgraded as part of the North Station reconstruction.

The Operations Control Center (OCC) equipment, bungalows/central instrument locations, wayside systems, and yard systems are universal throughout the subway system. Each has a useful life of 25 years, with the exception of the OCC equipment. Its useful life is based on the availability of spare parts for computers, which have a life cycle of 5 years.

Blue Line

Commuter Rail

The Authority's commuter rail signal system consists of over 480 miles of signalized track, 190 miles of aerial pole line, 80 interlockings, 10 train-control machines, over 1,000 signal heads, 476 electric switches, and 200 grade crossings with automatic protection equipment. There are also 35 bungalows and 52 bungalow/houses in the commuter rail signal system, and they all have a useful life of 25 years. The two

systemwide signal units are the wayside system and the OCC signal equipment. Both systems have a 25-year useful life.

Annual replacement of underground signal cable, aerial signal cable, electric switch machines, and electric grade crossing mechanisms is required to ensure the safety and reliability of the signal system within an effective life-cycle cost.

The MBTA has devoted $15.0 million towards commuter rail signals in the current Capital Investment Program, which is 8.1% of the total signal effort. Signal maintenance is performed under the commuter rail management contract and is funded primarily by the operating budget.

COMMUNICATIONS

Systemwide

The Communications Department is responsible for a variety of low-voltage systems at the MBTA. Its responsibilities include maintaining an extensive inventory of equipment and overseeing contract services for two-way radio systems, security systems, fire alarms, telephones, police/public call boxes, closed-circuit television, public address systems, light-emitting diode (LED) signs, and the Supervisory Control and Data Acquisition (SCADA) system. These systems have been developed over time and vary significantly in age and condition. The MBTA communications system also includes the OCC.

The Operations Control Center

The OCC is one of the most automated transit control centers in the world. It consists of proven, state-of-the-art, computer-based technology that permits real-time monitoring and supervisory control of the signal and communications systems for all four heavy rail/light rail lines. The Bus Radio System Network is also integrated into the OCC communications system. The OCC systems have a useful life of 25 years.

Telephone Equipment and Services

Telephone equipment has an average useful life of 4 years and includes:

- Electronic key and analog telephones
- ISDN equipment
- PENTA voice communications switches (controlling services for subway and bus dispatch)
- A wayside/emergency telephone network (pump rooms, emergency exits, vent shafts, bungalows, and rights-of-way)
- A voice-messaging system
- 650 public pay telephones
- A network of special services for communications applications
- A network of copper and fiber-optic cables

TABLE 5A–5
SIGNALS
Preservation and Replacement Costs over the Next Twenty Years

	High–Priority Costs	Medium–Priority Costs	Low–Priority Costs	Total 20–Year Costs
Commuter Rail	$209,579,040	$531,043,920	$201,920,400	$942,543,360
HR/Light Rail	$386,867,942	$475,786,008	$234,725,661	$1,097,379,611
TOTAL	$596,446,982	$1,006,829,928	$436,646,061	$2,039,922,971

Supervisory Control and Data Acquisition (SCADA) II

The SCADA II system monitors and controls equipment (fans, fire alarms, generators, pump rooms, etc.) at remote locations. The SCADA II system has a useful life of 20 years. It includes:

- A main and standby central processor
- Remote-control terminal cabinets

Systemwide Security

Systemwide security includes (useful life in parentheses):

- 28 closed-circuit television systems (5 years)
- Public address/signage systems (8 years)
- Security and alarm systems (20 years)
- Fire alarm systems (15 years)
- Police/public call boxes (10 years)

Systemwide Radios

The current radio system is an analog system and is programmed for replacement by a new digital system by the end of 2003. All systemwide radios have a useful life of 7 years, with the exception of base stations and support equipment, which last for 25 years. Current system components include:

- On-vehicle radios (bus, heavy rail and light rail)
- Non-revenue vehicle radios
- Police mobile radios
- Portable radios
- Base stations and support equipment
- Recorders

Commuter Rail Operations Control Center (CROCC)

The CROCC provides real-time monitoring and supervisory control of the signal and communications systems of the commuter rail network. The center features a Real-Time Active Train Summary display for lines controlled by the CROCC. There is a proposal to expand this system to provide data for lines controlled by Amtrak and Guilford.

POWER

For heavy rail, trackless trolley and light rail, the MBTA runs power, supplied by Dominion Power, through its own distribution equipment. The power system includes cables, substations, circuit breakers, switch boxes, switch heaters, manholes, ductiles (as well as storage facilities for cable and power equipment), switchboards, and circuit breakers. The power program also includes the catenary systems for the Green and Blue Lines, and overhead wire networks for the trackless trolley lines.

The commuter rail system's electrical network provides lighting and power for signal systems,

TABLE 5A-6
COMMUNICATIONS
Preservation and Replacement Costs over the Next Twenty Years

	High-Priority Costs	Medium-Priority Costs	Low-Priority Costs	Total 20-Year Costs
Commuter Rail	$11,919,051	$31,497,499	$7,600,172	$51,016,722
HR/Light Rail	$2,324,100	$25,831,800	$1,874,520	$30,030,420
Systemwide	$27,218,640	$26,875,740	$3,429,000	$57,523,380
TOTAL	$41,461,791	$84,205,039	$12,903,692	$138,570,522

communications systems, lift bridges, buildings, stations, parking lots, maintenance facilities, layover facilities, and grade crossings. The power program is also responsible for lighting at the following five ferry facilities: Lovejoy Wharf, Hingham Shipyard, World Trade Center, Long Wharf, and the Charlestown Navy Yard.

Heavy Rail/Light Rail

Power Substations

The MBTA maintains substation equipment to convert 13.8-kilovolt AC transmission–level power down to 600-volt DC distribution–level power to feed third-rail heavy rail loads and 480-volt AC distribution–level power for passenger stations, vent shafts, and signal bungalows. Substation equipment is expected to last 30 years. In addition, the Green Line has track switch equipment, which has a useful life of 15 years.

Unit Substations

Unit substation loads are various and include systems necessary for transportation, specifically the signal feeds, and other systems that protect both the customers and the system. There are 48 unit substations along the heavy rail/light rail system: 16 on the Red Line, 10 on the Green Line, 18 on the Orange Line, and 4 on the Blue Line. All substations are required to be in close proximity to the equipment they power. The useful life of a unit substation is 20 years.

Traction Power Substations

There are a total of 48 traction power substations in the heavy rail/light rail system: 25 on the Red Line, 7 on the Orange Line, 7 on the Blue Line, and 9 on the Green Line. Traction power stations have a useful life of 20 years.

Cable

The MBTA has over 3 million feet of AC cable distributed through the heavy rail/light rail system. It has a useful life of 40 years, except along the Green Line, where the useful life is 15 years. The Orange Line has over 600,000 feet of H-N negative cable, which has a useful life of 20 years. There are also 18 SWC MODs and cable on the Orange Line, and these cables have a useful life of 15 years. The Green Line has about 750,000 feet of DC feeder cable. The useful life of the DC cable is 30 years.

Overhead Contact Systems

Overhead contact systems (OCSs) are located along the Green and Blue Lines and on the Mattapan High Speed Line. These systems have a useful life of 20 years.

Passenger Station Low–Voltage Switchgears

There are 54 passenger station low-voltage switchgears in the heavy rail/light rail system. Low-voltage switchgears feed power to the signal system, pump rooms, car houses, escalators, elevators, and other various areas of the Authority's property where power is required. These systems provide protection for customers, Authority equipment, and the system overall. Along the Red and Orange Lines, these systems also feed fire alarm systems, the Amtrak signal system, ventilation equipment, and various other equipment. Passenger low-voltage switchgears have useful lives ranging from 20 to 30 years.

Commuter Rail

The commuter rail electrical system provides lighting and power for signal systems, communications systems, bridges, buildings, stations, parking lots, maintenance facilities, layover facilities (Bradford, Needham, and North Station), and grade crossings. It also provides redundant power at critical facilities and to cables to operate mechanical power on the Beverly Drawbridge.

Signal Systems

The commuter rail power programs are responsible for maintaining 366 switch heaters and 24 gas switch heaters. Both switch and gas switch heaters have 20-year useful lives.

Layover Facilities

Each layover facility's power control center has a 20-year useful life.

Systemwide

Systemwide power covers the main distribution system as well as the backup generators. This section also covers the catenary system for the trackless trolleys.

South Boston Power Complex Gas Turbines

The MBTA owns and maintains 2 emergency backup generators in South Boston. They exist primarily to provide power to the Authority's power grid if the BECo 115-kilovolt lines are lost. The jet turbine units and switch stations were built in the 1980s and provide backup power to 80% of the system. Each unit has a useful life of 25 years.

Supervisory Systems

There are two supervisory control systems that allow for continuous remote monitoring and control of all power facilities. The primary system, called Supervisory Control and Data Acquisition, employs two VAX computers that constantly poll all traction substations and present the received data on 4 workstation consoles located at Power Control. The backup system, called "One on One," employs a simplified system of point-to-point communication between microprocessors located at the CROCC and at the field sites. The received data are mapped onto an array of LEC lamps, which are read by dispatch personnel. The system has a useful life of 25 years.

Substation Equipment

Traction power substation equipment is used to convert 13.8-kilovolt AC transmission–level power to 600-volt DC distribution–level power (which feeds third-rail heavy rail loads) and to 480-volt AC distribution–level power (for passenger stations, vent shafts, and signal bungalows). The equipment used in the process consists of 15-kilovolt rated AC switchgear, rectifier transformers, DC rectifiers, 600-volt-rated DC switchgear, unit power transformers, station batteries, and supervisory control units. Substation equipment has a useful life of 25 to 30 years.

Unit Substations

There are 65 unit substations (USS) throughout the Authority. Unit substations provide power to lights, vents, and fans. The USS loads are various and include systems necessary for transportation, specifically the signal feeds, and other systems that protect both the customers and the system. Substations are required to be in close proximity to the equipment they power. The useful life of a unit substation is 20 years.

Substations

There are 10 substations: 7 located at Charlestown, 2 located at Everett Shops, and 1 heavy rail/light rail central control at 45 High Street. These substations were built in the 1970s. The useful life of a substation is 25 years.

YARD AND SHOP

Maintenance facilities, or yards and shops, are where the MBTA conducts regularly scheduled maintenance and emergency repairs on its vehicle fleets. The Authority maintains 4 heavy rail, 4 light rail, 3 commuter rail, and 9 bus yards and shops, including 1 bus repair shop. There are also 17 smaller general maintenance facilities throughout the system. A new

TABLE 5A-7
POWER
Preservation and Replacement Costs over the Next Twenty Years

	High-Priority Costs	Medium-Priority Costs	Low-Priority Costs	Total 20-Year Costs
Commuter Rail	$79,672,483	$72,492,477	$27,798,716	$179,963,676
HR/Light Rail and Trackless Trolley	$57,269,634	$180,261,310	$276,241,612	$513,772,556
Systemwide	$0	$2,560,320	$9,732,264	$12,292,584
TOTAL	$136,942,117	$255,314,107	$313,772,592	$706,028,816

facility is being constructed to maintain Silver Line vehicles. Each facility generally includes a basic building structure with a mechanical plant and shop equipment. The expected life cycle of each of these facilities is 50 years.

Heavy Rail/Light Rail

Maintenance facilities for heavy rail and light rail fleets include:

- A Red Line facility at Cabot
- An Orange Line facility at Wellington
- A Blue Line facility at Orient Heights
- Green Line facilities at Boston College, Riverside, Reservoir, and Mattapan Yard
- A main subway repair facility in Everett

All maintenance facilities have useful lives of 50 years. Included in this program are the basic structure of each facility and its critical maintenance equipment (lifts, hoists, etc.).

Commuter Rail

The commuter rail maintenance facilities are as follows.

- The Boston Engine Terminal (BET) is a new, state-of-the-art facility constructed in Somerville in 1997 consisting of over eight acres under one roof. The building consists of areas for service and inspection, periodic maintenance, wheel truing, coach repair, and locomotive repair, along with allied shops.
- The South Side Service and Inspection Facility is a two-track structure located at Wydett Circle in South Boston. This facility can accommodate two nine-car trains and has fueling and sanding capabilities as well as the ability to perform running repairs.
- The Readville Light Inspection facility was constructed at the same time as the BET. It is a Butler-type building with three tracks and capable of holding six coaches. It is dedicated to special projects such as retrofits, wheel truing and ACSES installation.

Commuter rail maintenance facilities, including their basic structure and critical maintenance equipment, have useful lives of 50 years.

Layover Facilities

The Authority has layover facilities at the following locations:

- Rockport
- Franklin
- Newburyport
- East Junction (Attleboro)
- Bradford
- Kingston
- Lowell

- Middleborough
- Fitchburg
- Worcester
- Needham
- Readville (midday storage)

Layover facilities are located at or near the end of commuter lines and are used as nighttime storage locations for train sets as well as points for fueling and performing minor repairs to rolling stock equipment. The construction of a new layover facility in Pawtucket, R.I., is anticipated to begin this year. Expansion of layover facilities in Worcester would be required to support expanded service. Relocation of midday layover facilities at Readville is a critical support element for the commuter rail network.

All layover facilities have a useful life of 50 years.

Commuter Rail Maintenance Storage Facilities

All commuter rail maintenance storage facilities have useful lives of 50 years. These facilities are:

- Readville Mechanical, Readville MOW, Abington MOW, Wilmington MOW, and Roland Street MOW

The following are the commuter rail equipment storage facilities:

- Lowell, Attleboro, Franklin, Rockport, and Wilmington

Bus

The Authority maintains seven bus garages and one central bus repair shop.

- Albany Street (built in 1941)
- Bartlett (1931)
- Cabot (1975)
- Charlestown (1979)
- Fellsway (1925)
- Lynn (1936)
- Quincy (1930)
- Everett Central repair shop

New facilities for maintaining CNG equipment are planned at Arborway and Southampton Street The Southampton Street facility will also house dual-mode equipment. The Arborway facility will replace the present Bartlett facility.

Bus maintenance facilities have a useful life of 50 years. Included in this program are the basic structure of each facility and its critical maintenance equipment (lifts, hoists, etc.).

A bus facility needs-assessment study is presently underway. This project is a master planning study of the bus maintenance facility needs for the MBTA that attempts to locate sites for such facilities. Currently, two are being built (Arborway and Southampton), one is scheduled for closure (Bartlett), and two will be retrofitted (Cabot and Everett) for maintenance of CNG vehicles. In addition, four other facilities—Albany, Lynn, Fellsway, and Quincy—may need to be either rebuilt or replaced.

Systemwide

Systemwide maintenance facilities include structures and buildings that the Authority uses for various tasks and purposes. There are 16 systemwide maintenance facilities:

- Cabot Heating Plant
- Auto Repair Facility
- Signal Repair Facility
- MOW Training and Backup CC
- Testing Lab
- Arborway Yard
- Oak Square Emergency Garage
- Campbell's Gate MOW
- Truck Storage and Repair
- Rail Bending Shop

- Light Maintenance Shop
- Heavy Maintenance Shop
- Pipefitter's Building
- Materials Storehouse
- Salt Sheds
- Rice Buildings

All systemwide maintenance facilities have a useful life of 50 years.

STATIONS

Heavy Rail/Light Rail

The MBTA has a total of 131 heavy rail and light rail stations, which includes 6 shared stations (North Station, Haymarket, State Street, Government Center, Park Street, and Downtown Crossing).

- The Red Line has a total of 22 stations
- The Orange Line has a total of 19 stations
- The Blue Line has a total of 12 stations
- The Green Line has a total of 71 stations on 4 routes:

  Boston College/B Line (23 stations), Cleveland Circle/C Line (13 stations), Riverside/D Line (13 stations), and Arborway/E Line (11 stations). The remaining 11 stations are on the Central Subway serving more than one branch.
- The Mattapan High speed line has 7 surface stations

Subway stations typically have a useful life of 50 years.

The MBTA is in the design process to modernize the Red Line stations in Dorchester (Ashmont, Shawmut, Fields Corner, and Savin Hill). As part of the effort to complete the ADA Key Station plan, other stations will be upgraded to meet accessibility requirements. Total costs of $131 million are anticipated.

Commuter Rail

There are four main commuter rail lines on the North Side of the system, which terminate at North Station. The South Side system has seven lines terminating at South Station. Four of the South Side lines also provide service to Back Bay Station. The MBTA currently has 129 commuter rail stations on these eleven commuter rail lines:

North Side

- North Station terminal
- 18 stations on the Newburyport/Rockport Line
- 13 stations on the Haverhill/Reading Line
- 8 stations on the Lowell Line
- 17 stations on the Fitchburg/South Acton Line

TABLE 5A-8
YARD AND SHOP
Preservation and Replacement Costs over the Next Twenty Years

	High-Priority Costs	Medium-Priority Costs	Low-Priority Costs	Total 20-Year Costs
Bus	$45,031,989	$117,916,108	$85,045,749	$247,993,846
Commuter Rail	$1,383,069	$9,379,157	$13,388,396	$24,150,622
HR/Light Rail	$21,760,426	$29,436,039	$96,809,558	$148,006,023
Systemwide	$52,901,531	$39,428,667	$176,524,841	$268,855,039
TOTAL	$121,077,015	$196,159,971	$371,768,544	$689,005,530

South Side

- South Station terminal
- Back Bay Station
- 18 stations on the Framingham/Worcester Line
- 3 stations on the Fairmount Line
- 12 stations on the Franklin Line
- 12 stations on the Attleboro/Stoughton Line
- 9 stations on the Middleborough/Lakeville Line
- 9 stations on the Needham Line
- 7 stations on the Plymouth/Kingston Line

Commuter rail stations have useful lives ranging from 35 to 70 years, depending upon structure type. Commuter rail stations generally consist of a low-level platform with lights, shelters, and other components. Mini-high platforms are provided at most stations and full high-level platforms are found along the Old Colony lines, at the downtown terminals, and at Worcester Station. System expansion brought 4 new commuter rail stations online in 2001 and 2002, including Southborough, Westborough, and Ashland on the Worcester Branch; and JFK/UMass on the Old Colony Branch. A new station at the Anderson Regional Transportation Center in Woburn opened in 2001. Minor commuter rail station improvements are also made as part of parking improvement and expansion projects. Currently, station improvements are programmed as part of parking projects at the Wilmington and Hamilton/ Wenham stations.

Silver Line

There are 13 new Silver Line stations in service between Downtown Crossing and Dudley as of 2002, including the pre-existing Dudley Station. Three additional Silver Line stations along the South Boston Piers Transitway will open in 2003. Silver Line stations are expected to have a useful life of 50 years.

Bus

The MBTA operates approximately 170 bus and trolley routes, which serve about 9,000 bus stops. In general, capital components found at bus stops include only bus stop signage. Some also have benches and 303 include shelters. There are several major bus terminals (e.g., Harvard Square, Ruggles, Ashmont, and Forest Hills), but with the exception of the South Station Transportation Center and Dudley Station, these structures are considered part of intermodal subway stations. All bus stations have useful lives of 50 years.

Boat

Docking facilities for commuter boat service are owned, leased, or utilized in Hingham, Hull, Quincy, and Charlestown, and at Lovejoy Wharf, Rowes Wharf, and Long Wharf.

TABLE 5A-9
STATIONS
Preservation and Replacement Costs over the Next Twenty Years

	High-Priority Costs	Medium-Priority Costs	Low-Priority Costs	Total 20-Year Costs
Commuter Rail	$56,422,004	$18,503,968	$43,372,561	$118,298,533
Boats	$0	$694,944	$1,085,088	$1,780,032
HR/Light Rail	$77,655,633	$183,418,699	$151,644,543	$412,718,875
TOTAL	$134,077,637	$202,617,611	$196,102,192	$532,797,440

FACILITIES

Heavy Rail/Light Rail

Heavy rail/light rail facilities include administrative buildings and operators' lobbies on each of the lines, ventilation structures, and other miscellaneous structures.

Commuter Rail

Commuter rail facilities include any structures or facilities at the eleven outlying layover points, five maintenance buildings and five storage buildings throughout the system. It also includes the administrative facility operation center at Cobble Hill.

Fencing along the commuter rail system is used to prevent trespassing, and to protect pedestrians and MBTA property. It is necessary to keep trespassers from interfering with fast moving trains, and also to prevent illegal dumping of trash and contaminated materials.

Boat

As noted in the previous section, docking facilities are owned or leased in Quincy, Hingham, Hull, and Boston to support the commuter boat operation.

Systemwide

Systemwide facilities include administrative buildings and other miscellaneous structures owned by the MBTA. These include inactive structures, noise walls, office buildings, and systemwide support facilities. MBTA-owned administrative buildings include 45 High Street, 500 The Arborway, Arlington Avenue (Charlestown), the commuter rail operations facility at Cobble Hill, the Quality Control Facility on Freeport Street, and the police station on Southampton Street. The MBTA facility program also includes the ferry pier at Hingham. Other ferry facilities are leased.

ELEVATORS AND ESCALATORS

Systemwide

The Authority has 100 elevators and 132 escalators located throughout the system. All elevators and escalators have 20-year useful lives.

PARKING

Systemwide

Parking lots and garages are also included here. The MBTA owns approximately 31,400 surface parking spaces and 10,600 garage spaces with useful lives of 50 years.

TUNNELS, WALLS,AND CULVERTS

Systemwide

Tunnels, walls, and culverts are located throughout the system. Tunnels are mainly on the core subway system and in several locations in the commuter rail network. The heavy rail

TABLE 5A–10
FACILITIES
Preservation and Replacement Costs over the Next Twenty Years

	High–Priority Costs	Medium–Priority Costs	Low–Priority Costs	Total 20–Year Costs
Bus	$970,184	$2,815,021	$528,888	$4,314,093
Commuter Rail	$0	$28,512,000	$29,462,400	$57,974,400
HR/Light Rail	$3,142,101	$35,973,397	$18,043,259	$57,158,757
Systemwide	$4,894,372	$8,342,373	$7,234,446	$20,471,191
TOTAl	$9,006,657	$75,642,791	$55,268,993	$139,918,441

TABLE 5A-11
ELEVATORS AND ESCALATORS
Preservation and Replacement Costs over the Next Twenty Years

	High-Priority Costs	Medium-Priority Costs	Low-Priority Costs	Total 20-Year Costs
Commuter Rail	$0	$0	$401,637	$401,637
Bus	$0	$0	$401,637	$401,637
HR/Light Rail	$47,068,263	$51,241,643	$21,852,731	$120,162,637
Systemwide	$0	$8,032,750	$0	$8,032,750
TOTAl	$47,068,263	$59,274,393	$22,656,005	$128,998,661

system has 14 miles of tunnels. The light rail system has 5 miles of tunnels. Tunnels generally have a useful life of 100 years. The MBTA's network of retaining walls and culverts is also extensive. There are 767 culverts along the commuter rail system and 16 on the subway system. All culverts have a useful life of 50 years. Retaining walls also have a useful life of 50 years and are located along the commuter rail and rapid transit systems.

BRIDGES

Systemwide

The MBTA maintains 560 bridges, made up of 412 railroad bridges, 60 transit bridges, and 88 highway bridges (carrying vehicles over track and rights-of-way). Railroad and transit bridges typically have a useful life of 70 years, while highway bridges have a useful life of 50 years. Both railroad and transit bridges have the same maintenance schedule. Renewal of bridge deck replacement occurs after 50 years of use. Bridge

TABLE 5A-12
PARKING
Preservation and Replacement Costs over the Next Twenty Years

	High-Priority Costs	Medium-Priority Costs	Low-Priority Costs	Total 20-Year Costs
Commuter Rail	$0	$22,735,460	$7,151,507	$29,886,967
HR/Light Rail	$2,389,178	$166,713,442	$23,463,246	$192,565,866
TOTAL	$2,389,178	$189,448,902	$30,614,753	$222,452,833

TABLE 5A-13
TUNNELS, WALLS, AND CULVERTS
Preservation and Replacement Costs over the Next Twenty Years

	High-Priority Costs	Medium-Priority Costs	Low-Priority Costs	Total 20-Year Costs
Bus	$9,408,960	$0	$0	$9,408,960
Commuter Rail	$7,574,391	$0	$0	$7,574,391
HR/Light Rail	$83,904,579	$0	$0	$83,904,579
TOTAL	$100,887,930	$0	$0	$100,887,930

deck waterproofing is replaced after 40 years, and steel is repainted after 30 years. Highway bridges, however, have a different maintenance schedule. Bridge deck replacements occur after 30 years of use and steel is repainted every 15 years.

In an effort to upgrade and maintain these bridges, the Authority has developed a bridge management program known as the PONTIS program. This program is used to evaluate the condition of each bridge based on results of an inspection and a load-rating analysis of the bridge. This program also establishes a priority list for the rehabilitation/reconstruction of bridges. A bridge inspection program is tailored to ensure that all the bridges receive adequate attention. The frequency and type of inspection for each bridge depends on the structural condition of the bridge. For example, some bridges are considered fracture critical, and some are posted for speed and load restrictions. Bridges in good condition receive a routine inspection every 24 months, while fracture critical bridges receive an in-depth inspection every 12 months.

The PONTIS program enables the Authority to maintain an up-to-date database of all the Authority-owned bridges. It also contains information on the frequency of inspection for each bridge, and detailed structural information such as the bridge description, dimensions, and the conditions of the deck, superstructure, and substructural elements. The database also contains inventory and operating values of each bridge, which indicate the load carrying capacity of the structure. A priority list for rehabilitation/replacement is established based on the ratings.

Bridge replacement projects which have been identified as priorities through the PMT process include upgrades to the Fairmount commuter rail line at Columbia Road and upgrades to the Mattapan line viaduct at Ashmont Station.

FARE EQUIPMENT

Systemwide

The MBTA's fare-collection system differs by mode and includes station-based, vehicle-based, and system-control equipment. On the subway/rapid transit system, fare-collection equipment includes 475 turnstiles at 90 barrier fare collection locations. Fare-collection booths and exit gates at rapid transit stations are also considered to be part of the fare-collection system as well as on-board conductors, who perform fare-collection on the commuter rail system. There is no associated capital equipment for commuter rail.

The existing fare-collection equipment is 25 to 30 years old. Continued upkeep of the existing system is increasingly expensive due to its age and the cost of replacement parts. The Authority has initiated the procurement of a new Automated Fare Collection (AFC) system. This procurement calls for new fare-collection equipment for the Authority's subway, bus, trackless trolley, and Green Line services. All existing fare collection equipment will be

TABLE 5A–14
BRIDGES
Preservation and Replacement Costs over the Next Twenty Years

	High–Priority Costs	Medium–Priority Costs	Low–Priority Costs	Total 20–Year Costs
Commuter Rail	$57,181,678	$131,966,566	$46,442,775	$235,591,019
HR/Light Rail	$47,756,564	$148,923,919	$80,013,508	$276,693,991
TOTAL	$104,938,242	$280,890,485	$126,456,283	$512,285,010

TABLE 5A-15
FARE EQUIPMENT
Preservation and Replacement Costs over the Next Twenty Years

	High-Priority Costs	Medium-Priority Costs	Low-Priority Costs	Total 20-Year Costs
TOTAL	**$101,508,098**	**$11,006,013**	**$89,638,667**	**$202,152,778**

replaced. The overall project has three major components: procurement of the AFC equipment and related construction work required for its installation, initiation of a new station management structure that provides an enhanced level of customer convenience, and installation of a state-of-the-art telecommunications infrastructure that will improve station security. The Revenue Department also maintains and operates control, counting, and security equipment through a central computer system at a central facility. Wayside equipment has a 17-year useful life. Associated software is also maintained.

ADMINISTRATION

Systemwide

As with any large organization, the Authority assumes a cost to conduct business. The Authority must provide administrative offices and a working environment equipped with computers, phones, furniture, and the necessary systems and support services to carry out their responsibilities effectively and efficiently. Also included are costs required to support administration of the capital program. These costs include the cost of bond issuance as well as engineering support services. Much of the MBTA's computer equipment (PCs, printers, etc.) was upgraded as part of the year 2000 program. The Authority has one enterprise server (mainframe) that services the MBTA's computer network supporting over 2000 external devices. The server is assigned a 6-year useful life. The Authority has 1500 computers systemwide (not including police), which are impacted directly by the advances in technology. They have a useful life of 3 years. The MBTA police department also has 117 computers, each having a useful life of 5 years.

It is anticipated that $1.6 million will be required for the acquisition of a new computer system used for THE RIDE passenger reservations and vehicle scheduling.

TABLE 5A-15
ADMINISTRATION
Preservation and Replacement Costs over the Next Twenty Years

	High-Priority Costs	Medium-Priority Costs	Low-Priority Costs	Total 20-Year Costs
TOTAL	**$5,406,237**	**$11,886,591**	**$6,572,707**	**$23,865,535**

P M T

CHAPTER 5B

Service Enhancements

Service enhancements consist of suggested projects that would improve the service provided on MBTA routes that are already in operation. In general, these projects would not extend service to any new locations. The service enhancement projects discussed in this chapter are divided into three categories with separate evaluation criteria.

The first category, General Enhancements, includes changes such as increased frequency and improvements to vehicle fleets or fixed facilities to make possible faster, more comfortable, or more reliable service. The evaluation criteria for projects in this category are discussed in Chapter 1. The second category, Accessibility Enhancements (see pages 5B-28–5B-31), includes projects to improve accessibility for passengers with disabilities, such as installation of elevators at rapid transit stations and installation of high-level platforms at commuter rail stations. The third category, Access to Service (see pages 5B-32–5B-36), includes projects to improve general access to transit stations, such as parking expansion, installation of bicycle racks, and improvements to pedestrian approaches. The evaluation criteria used for projects in the second and third categories are discussed in their respective sections in this chapter. Most cost estimates and all ridership estimates for each of the categories were developed by CTPS. Additional details on quantitative indicators for individual projects may be found in Appendix C.

Each project has been given a rating for each of the evaluation criteria applicable to it and has also, based on those ratings, been given an overall rating. The ratings are indicated using the following icons:

● High rating

◗ Medium rating

❍ Low rating

The overall rating given to each project reflects whether implementation of the project is a high, medium, or low priority.

For each project that has its own page, its overall rating is given at

the upper left corner of the page and its ratings by individual criterion are given at the bottom. For the projects that do not have their own page, all of the ratings are given in tabular form. Within each of the three categories of projects, the projects are grouped by overall rating, the high-priority projects being presented first, medium-priority next, and low-priority last.

For each project, both the overall rating and the ratings by criterion were based on performance relative only to the other projects being evaluated within the same mode. For this purpose, the projects were divided into four modes: rapid transit (including the Red, Orange, Blue, Green, and Silver Lines, and Phase 2 and 3 Urban Ring), commuter rail, bus/trackless trolley, and other modes.

GENERAL ENHANCEMENTS

When the ratings by individual criterion of the General Enhancement projects, given at the bottom of the following pages, were combined to produce an overall rating for the project, a ❍ was considered to be equivalent to 1/3 of a ●, and 1/2 of a ◗. Additional information on the evaluation of these projects is provided in Appendix A.

SIGNAL AND TRAIN CONTROL IMPROVEMENTS ON BLUE LINE

Description

This proposal calls for increasing peak capacity on the Blue Line by installing new-generation signal systems which will allow for closer spacing between trains than present signal equipment allows. Infrastructure investments required to accomplish this would include installation of Communication-Based Train Control (CBTC) equipment, expanding storage yards, expanding power system capacity, and purchasing additional rolling stock. Present peak spacing between trains on the Blue Line is 3.5 minutes on average. Applying new signal technology could allow train frequencies of every 2 minutes, a 75% increase in capacity.

Capital Features

Installation of new signal system, purchase of additional vehicles, expansion of yard storage capacity, and expansion of power system.

Capital Cost	**$228.1 million**
Operating Cost	**$41,500 per weekday**
Daily Ridership Increase on Mode	**8,800**
Net Increase in Daily Transit Ridership	**2,700**
Capital Cost/New Transit Rider	**$84,500**
Operating Cost per Wkday/New Transit Rider	**$15.40**
Capital Cost/Travel Time Benefit	**$465,700 per hour**
Operating Cost/Travel Time Benefit	**$84.80 per hour**
Travel Time Savings	**490 hours per weekday**

Assessment

This is a high-priority rapid transit enhancement project. The capital cost of this project would be $228.1 million and the increase in the typical daily operating cost would be $41,500. Expanding the capacity of the Blue Line through signal improvements and the expansion of the vehicle fleet would result in 8,800 new riders to the mode, of which 2,700 would be new transit riders. The capital cost would be $84,500 per new transit rider, and the operating cost would be $15.40 per new transit rider. The project receives a medium score for capital cost per new transit rider, a good score for operating cost per new transit rider, and a high cost-effectiveness ranking overall compared to other rapid transit system enhancement projects. Utilization would be high, as new riders would be attracted by the improved peak frequencies. Peak crowding conditions presently occur between Aquarium and Maverick Stations. Crowding would be reduced. System reliability would be improved by the replacement of old signal equipment.

The MBTA is presently completing a project to modernize the Blue Line and increase the Blue Line train maximum length from four cars to six cars. Completion of this project should result in reductions in crowding within the next five years. The costs and calculations used in this analysis assume a 75% increase in capacity over operating future six-car trains of Blue Line cars at present frequencies. If future demand warrants a lesser increase in capacity, capital and operating costs could be lowered.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Environ. Justice
Facility Improvement	●	❍	●	●	◗	◗

SIGNAL AND TRAIN CONTROL IMPROVEMENTS ON RED LINE

Description

This proposal calls for increasing peak capacity on the Red Line by installing new-generation signal systems that will allow for closer spacing between trains than present signal equipment allows. Present peak spacing between trains in the shared segment of the Red Line between Alewife and Andrew Stations is 3.5 minutes on average. Applying new signal technology could allow train frequencies of every 2 minutes, a 75% increase in capacity.

Capital Features

Installation of a new Communication-Based Train Control (CBTC) signal system, purchase of additional vehicles, expansion of yard storage capacity, and expansion of power system.

Capital Cost	**$789.4 million**
Operating Cost	**$128,800 per weekday**
Daily Ridership Increase on Mode	**9,700**
Net Increase in Daily Transit Ridership	**3,400**
Capital Cost/New Transit Rider	**$233,500**
Operating Cost per Wkday/New Transit Rider	**$38.10**
Capital Cost/Travel Time Benefit:	**$1,447,300 per hour**
Operating Cost/Travel Time Benefit	**$236.30 per hour**
Travel Time Savings	**545 hours per weekday**

Assessment

This is a high-priority rapid transit enhancement project. The capital cost of this project would be $789.4 million and the increase in the typical daily operating cost would be $128,800. Expanding the capacity of the Red Line through signal improvements and the expansion of the vehicle fleet would result in 9,700 new riders to the mode, of which 3,400 would be new transit riders. The capital cost would be $233,500 per new transit rider and the operating cost would be $38.10 per new transit rider. This results in a medium score for capital costs and a high score for operating costs per new transit rider compared to other rapid transit expansion projects. Peak crowding conditions are presently experienced on the Red Line between Central and Kendall on the northern section of the line and between South Station and Broadway on the southern section of the line. The utilization score for the project is high as ridership would increase, new riders would be attracted to the mode, mode share would increase, and crowding would be reduced. System reliability would be improved with the installation of new signal equipment in place of older, more failure-prone equipment. The cost calculations used in assessing the project assume a 75% increase in capacity. If future demand warrants a lesser increase in capacity, capital and operating costs could be lowered.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Environ. Justice
Facility Improvement	●	○	◗	●	◗	○

SIGNAL AND TRAIN CONTROL IMPROVEMENTS ON ORANGE LINE

Description

This proposal calls for increasing peak capacity on the Orange Line by installing new-generation signal systems that will allow for closer spacing between trains than present signal equipment allows. Present peak spacing between trains on the Orange Line is 4.5 minutes on average. Applying new signal technology could allow train frequencies of every 2 minutes, a 125% increase in capacity. Orange Line improvements are an ACO legal commitment (see Table 2-2).

Capital Features

Installation of new Communication Based Train Control (CBTC) signal system, purchase of additional vehicles, expansion of yard storage capacity, and expansion of power system.

Capital Cost	**$367.0 million**
Operating Cost	**$78,100 per weekday**
Daily Ridership Increase on Mode	**10,900**
Net Increase in Daily Transit Ridership	**4,500**
Capital Cost/New Transit Rider	**$82,100**
Operating Cost per Wkday/New Transit Rider	**$17.50**
Capital Cost/Travel Time Benefit	**$449,100 per hour**
Operating Cost/Travel Time Benefit	**$95.90**
Travel Time Savings	**815 hours per weekday**

Assessment

This is a high-priority rapid transit enhancement project. The capital costs for this project would be $367 million, and the increase in the typical daily operating cost would be $78,100. Expanding the capacity of the Orange Line through signal improvements and the expansion of the vehicle fleet would result in 10,900 new riders to the mode, of which 4,500 would be new transit riders. The capital cost would be $82,100 per new transit rider and the operating cost would be $17.50 per new transit rider. This results in a medium score for both capital costs and operating costs per new transit rider compared to other rapid transit expansion projects. Currently, the most severe peak crowding conditions occur between Community College and State Street on the northern end of the line and between Back Bay Station and Downtown Crossing on the southern end of the line. The utilization score for the project is high, as mode ridership would increase, new transit riders would be attracted, mode share would increase, and crowding would be reduced. System reliability would be improved with the installation of new signal equipment in place of older, more failure-prone equipment.

The cost calculations used in assessing the project assume a 125% increase in capacity. The MBTA is proceeding with plans to replace antiquated signals between State Street and Oak Grove as a system preservation project. This signal replacement project will increase line capacity, but by a smaller percentage increase than this analysis considered. If future demand warrants a lesser increase in capacity than anticipated by this analysis, there may be no need for additional improvements beyond those already programmed.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Environ. Justice
Facility Improvement	●	❍	●	●	◗	◗

INSTALL 300 SHELTERS

Description

This proposal calls for the installation of 300 new bus shelters. Bus shelters protect passengers from inclement weather and provide seating for passengers awaiting buses. Shelters would primarily be placed at stops with high ridership and adequate space for shelters.

Capital Features

Purchase 300 bus shelters.

Capital Cost	**$1.0 million**
Operating Cost	**No ncrease in operating cost**
Daily Ridership Increase on Mode	**No impact**
Net Increase in Daily Transit Ridership	**No impact**
Capital Cost/New Transit Rider	**No impact**
Operating Cost per Wkday/New Transit Rider	**NA**
Capital Cost/Travel Time Benefit	**No impact**
Operating Cost/Travel Time Benefit	**NA**

Assessment

Installing new bus shelters would have no measurable impact on ridership, but would improve the quality of service for existing riders. Installing shelters along well-utilized routes would result in quality-of-service improvements for many environmental justice target areas, especially those with a high concentration of transit-dependent residents. Shelters could provide opportunities to post additional public information about routes, such as schedules, fare information, maps, and other marketing campaigns. Shelters are targeted for stops with 100 or more boardings per day.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Environ. Justice
Facility Improvement	NA	❍	NA	NA	◗	●

INSTALL INTELLIGENT TRANSPORTATION SYSTEMS (ITS) FOR BUS FLEET

Description

This proposal calls for making real-time bus location data available to both passengers and MBTA managers, and using this technology to reduce bus travel times through signal prioritization.

Capital Features

Install ITS subsystem, including Automatic Vehicle Locator systems and Automatic Passenger Counters.

Capital Cost	**To be determined**
Operating Cost	**No increase in operating cost**
Daily Ridership Increase on Mode	**No impact**
Net Increase in Daily Transit Ridership	**No impact**
Capital Cost/New Transit Rider	**NA**
Operating Cost per Wkday/New Transit Rider	**NA**
Capital Cost/Travel Time Benefit	**NA**
Operating Cost/Travel Time Benefit	**NA**

Assessment

There is no measurable impact on ridership associated with this project. However, providing real-time service performance data would give bus dispatchers more information with which to make immediate service adjustments and would give passengers information on the time of the next bus arrival. Bus location data could also be tied into traffic signal priority systems. Adding Automatic Passenger Counters would provide ridership data for every stop on a route and would also give planners more and better data to adjust schedules and improve bus reliability. Overall, Intelligent Transportation Systems could improve passenger perceptions of bus service and make bus service more attractive. Installation of an ITS network could be incremental, as Automatic Vehicle Locator systems could be installed on vehicles first as part of improved communication packages, while other items such as bus information kiosks at stops could be installed on a route-by-route basis. Automatic Passenger Counters would only need to be installed on 10-15% of the bus fleet.

Type of Project	Utilization	Mobility	Cost-Effectiveness.	Air Quality	Service Quality	Environ. Justice
Travel Time Improvement	NA	❍	NA	NA	●	◗

EXPAND REVERSE COMMUTING OPTIONS

Description

This project would increase the possibilities for commuting from homes in Boston to suburban work locations by expanding commuter rail service to provide at least three outbound A.M. peak trips and at least three inbound P.M. peak trips at all stations serving significant employment areas. New shuttle bus services would need to be provided between suburban stations and employment centers beyond walking distance of them.

Capital Features

At least five new train sets would be required in order to bring reverse-commuting service on all lines up to minimum standards while also maintaining present levels of peak-direction service.

Capital Cost	**$82.7 million**
Operating Cost	**$60,600 per weekday (excluding shuttle bus connections)**
Daily Ridership Increase on Mode	**7,800**
Net Increase in Daily Transit Ridership	**3,100**
Capital Cost per New Transit Rider	**$26,500**
Operating Cost per Wkday/New Transit Rider	**$19.40**
Capital Cost/Travel Time Benefit	**$90,900 per hour**
Operating Cost/Travel Time Benefit	**$67.00 per hour**
Travel Time Savings	**910 hours per weekday**

Assessment

This project would open new possibilities for suburban employment to residents of Boston's urban core. Many suburban employment locations have no transit links from Boston, or have service with arrival and departure times incompatible with starting and ending times of work shifts. This project would enhance service on MBTA commuter rail lines to provide multiple outbound A.M. peak and inbound P.M. peak trips between Boston and major suburban employment centers. At best, however, most reverse commuters would face time-consuming journeys on such service. The majority would need to use rapid transit or bus service to access commuter rail in Boston. In most cases, shuttle bus connections between the stations and the work locations would be needed at the outer trip end. (The cost of such services is assumed above to be funded by sources other than the MBTA.) At full potential, reverse-commuting service would be among the more cost-effective commuter rail projects analyzed in terms of capital cost per new transit rider. Operating cost per new rider would be in the mid-range among projects. Stations at which shuttle services appear most promising are Anderson/Woburn, Waltham, Route 128, and Southborough. These all have some present or planned shuttles. Overall, this project is rated high priority.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Environ. Justice
Frequency Improvement	●	●	◗	◗	◗	◗

OPERATE A YAWKEY–BACK BAY–SOUTH STATION SHUTTLE

Description

This project would implement a short-turn commuter rail service on the Framingham/Worcester Line between Yawkey Station in the Fenway section of Boston and South Station. Service would run every 15 to 20 minutes during peak hours and every 30 minutes at other times.

Capital Features

The existing Yawkey Station would be reconfigured to provide platforms on both tracks. A set of crossovers would be installed to allow trains to change tracks near the station. Three train sets would be needed to provide service at times of maximum frequency.

Capital Cost	**$29.9 million**
Operating Cost	**$4,600 per weekday**
Daily Ridership Increase on Mode	**1,400**
Net Increase in Daily Transit Ridership	**380**
Capital Cost per New Transit Rider	**$78,900**
Operating Cost per Wkday/New Transit Rider	**$12.00**
Capital Cost/Travel Time Benefit	**$3,748,000 per hour**
Operating Cost/Travel Time Benefit	**$571.80 per hour**
Travel Time Savings	**8 hours per weekday**

Assessment

This project would provide an alternative to the Green Line for travel between the Fenway and Copley Square areas, and an alternative to a combination of the Green and Red Lines for travel between the Fenway and the Waterfront and Financial/Retail districts. Some service between Yawkey, Back Bay, and South Stations is already provided by through commuter rail trains, but shuttle service would be much more frequent. It would provide more frequent connections to Back Bay Station than are currently available for passengers on the Fairmount Line and the Old Colony lines, which terminate at South Station and do not pass through Back Bay. The Framingham/Worcester Line is the only commuter rail route running via Yawkey Station. This would be among the more cost-effective commuter rail projects in terms of operating expense relative to new ridership. It would be in the mid-range of such projects in capital cost per new transit rider. Overall it is rated high priority.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Environ. Justice
Frequency Improvement	◗	◗	◗	◗	◗	●

OPERATE MORE FREQUENT SERVICE BETWEEN FRAMINGHAM AND WORCESTER

Description

This project would improve commuter rail service on the outer end of the Framingham/Worcester Line by changing one peak-period Worcester local round trip to an express and adding a new local round trip at a different time.

Capital Features

This project would require no capital investment if the additional train was run at a time of day when the equipment would otherwise be idle.

Capital Cost	**None**
Operating Cost	**$4,500 per weekday**
Daily Ridership Increase on Mode	**900**
Net Increase in Daily Transit Ridership	**450**
Capital Cost per New Transit Rider	**None**
Operating Cost per Wkday/New Transit Rider	**$10.00**
Capital Cost/Travel Time Benefit	**None**
Operating Cost/Travel Time Benefit	**$20.00 per hour**
Travel Time Savings	**220 hours per weekday**

Assessment

This project would provide faster travel times to Boston for some passengers boarding Framingham/Worcester Line trains at stations west of Framingham, and would provide an additional off-peak trip in each direction. It would be very cost-effective if operated with rolling stock that would otherwise be idle. The operating cost per new rider would be among the lowest for all commuter rail projects analyzed. The total number of weekday round trips between Boston and Worcester would increase from 10 to 11. The Worcester station is located in the central business district of the second-largest city in the state. Overall this project is rated high priority.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Environ. Justice
Frequency Improvement	◗	◗	●	◗	❍	●

D OPERATE 8-CAR TRAINS ON ORANGE LINE

Description

The proposal calls for expanding capacity on the Orange Line by operating maximum train lengths of eight cars in the peak period. Present maximum train lengths are six cars. Longer trains would expand line capacity by over 30% and accommodate projected future increases in ridership

Capital Features

Extend station platforms, expand yard capacity, expand power capacity, modify signal systems, and expand vehicle fleet to support the operation of 8-car trains.

Capital Cost	**$177.7 million**
Operating Cost	**$26,000 per weekday**
Daily Ridership Increase on Mode	**3,300**
Net Increase in Daily Transit Ridership	**700**
Capital Cost/New Transit Rider	**$269,200**
Operating Cost per Wkday/New Transit Rider	**$39.50**
Capital Cost/Travel Time Benefit	**$1,198,700 per hour**
Operating Cost/Travel Time Benefit	**$175.40 per hour**
Travel Time Savings	**149 hours per weekday**

Assessment

This is a medium-priority rapid transit enhancement project. The capital costs associated with this project would be $177.7 million and the typical daily operating cost would be $26,000. The project would attract 3,300 new riders to the mode of which 700 would be new to transit. The capital costs per new rider would be $269,200 and the operating cost per new rider would be $39.50. The cost effectiveness score for the project is medium for both capital and operating expenses per new rider compared to other rapid transit expansion projects. Currently, the most severe peak crowding conditions occur between Community College and State Street on the northern end of the line and between Back Bay Station and Downtown Crossing on the southern end of the line. This project would reduce crowding for existing riders, but would only have a moderate impact on attracting new riders. Because of the low number of new riders attracted, there would only be a moderate impact on air quality. Crowding would be reduced in environmental justice target communities served by the Orange Line.

Extending station platforms would require excavations at underground station locations, and could result in major utility relocation and impacts on abutting properties in downtown Boston.

Improving signal systems to allow more frequent peak service is another alternative considered within the PMT to increase capacity.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Environ. Justice
Facility Improvement	◗	❍	◗	◗	❍	●

D OPERATE 8-CAR TRAINS ON RED LINE

Description

The proposal calls for expanding capacity on the Red Line by operating maximum train lengths of eight cars in the peak period. Present maximum train lengths are six cars. Infrastructure investments required to accomplish this would include extending station platforms, expanding storage yards, expanding power system capacity, modifying signal blocks, and purchasing additional rolling stock. Longer trains would expand line capacity by over 30% and accommodate projected future increases in ridership

Capital Features

Extend station platforms, expand yard capacity, expand power capacity, and expand vehicle fleet to support the operation of 8-car trains.

Capital Cost	**$261.3 million**
Operating Cost	**$42,900 per weekday**
Daily Ridership Increase on Mode	**3,800**
Net Increase in Daily Transit Ridership	**1000**
Capital Cost/New Transit Rider	**$275,100**
Operating Cost per Wkday/New Transit Rider	**$45.20**
Capital Cost/Travel Time Benefit	**$1,610,100 per hour**
Operating Cost/Travel Time Benefit	**$264.60**
Travel Time Savings	**162 hours per weekday**

Assessment

This is a medium-priority rapid transit enhancement project. The capital costs associated with this project would be $261.3 million and the increase in typical daily operating costs would be $275,100. The project would attract 3,800 new riders to the mode of which 1000 would be new to transit. The capital costs per new rider would be $275,100 and the operating cost per new rider would be $45.20. The cost effectiveness score for the project is medium for both capital and operating expenses per new rider. Peak crowding conditions are presently experienced between Central and Kendall on the northern section of the line and between South Station and Broadway on the southern section of the line. This project would reduce crowding for existing riders, but would only have a moderate impact on attracting new riders. Because of the low number of new riders attracted, there would only be a moderate impact on air quality.

Extending station platforms would require excavations at underground station locations, and could result in major utility relocation and impacts on abutting properties in downtown Boston and Cambridge.

Improving signal systems to allow more frequent peak service is another alternative considered in the PMT to increase capacity.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Environ. Justice
Facility Improvement	◗	❍	◗	◗	❍	◗

D PREEMPTIVE SIGNALS ON BEACON, COMMONWEALTH, AND HUNTINGTON

Description

This proposal calls for the installation of preemptive signals along the segments of the Green Line which operate in street medians with frequent grade crossings. The signal equipment would extend a green light cycle for an approaching rail vehicle or decrease the green cycle for crossing vehicular traffic. This signal equipment would reduce the time streetcars must wait at crossings and decrease trip times along these segments.

Capital Features

Install new signals.

Capital Cost	**$0.5 million**
Operating Cost	**no increase in operating costs**
Daily Ridership Increase on Mode)	**270**
Net Increase in Daily Transit Ridership	**60**
Capital Cost/New Transit Rider	**$8,200**
Operating Cost per Wkday/New Transit Rider	**no change**
Capital Cost/Travel Time Benefit	**$29,800 per hour**
Operating Cost/Travel Time Benefit	**NA**
Travel Time Savings	**17 hours per weekday**

Assessment

This is a medium-priority rapid transit enhancement project. The capital costs for this project would be $0.5 million. Improved running times resulting from the installation of preemptive signals would attract 270 new riders to the mode of which 60 would be new to transit. The capital cost per new transit rider would be $8,200. Although the ridership impact is small, the low capital costs results in this project being of comparatively high cost effectiveness compared to other rapid transit enhancement projects. To get the greatest benefit from traffic pre-emption equipment, it may also be required to relocate several surface stations to the far sides of intersections. Service reliability should improve, as there would be fewer delays at crossing locations.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Environ. Justice
Travel Time Improvement	❍	❍	●	◗	❍	◗

D ADD EXCLUSIVE LANES AND PRIORITY SIGNALS ALONG THE TOP TEN HIGHEST RIDERSHIP BUS OR TRACKLESS TROLLEY ROUTES

Description

This proposal calls for the installation of exclusive bus lanes and bus priority signals along high-ridership local bus routes. Exclusive bus lanes reduce the amount of time spent in congestion and mixed traffic and could result in faster, more reliable bus service. Routes 1 (Harvard-Dudley), 15 (Kane Square-Ruggles), 22 (Ashmont-Ruggles), 23 (Ashmont-Ruggles), 32 (Wolcott Square-Forest Hills), 28 (Mattapan-Ruggles), 57 (Watertown-Kenmore), 66 (Harvard-Dudley), 73 (Waverley Square-Harvard), and 111 (Woodlawn-Haymarket) are candidates for such improvements.

Capital Features

Construct exclusive bus lanes, bus priority signals, and shelters with passenger amenities.

Capital Cost	**$53.1 million**
Operating Cost	**No increase in operating costs**
Daily Ridership Increase on Mode	**3,000**
Net Increase in Daily Transit Ridership	**800**
Capital Cost/New Transit Rider	**$68,100**
Operating Cost per Wkday/New Transit Rider	**NA**
Capital Cost/Travel Time Benefit	**$211,400 per hour**
Operating Cost/Travel Time Benefit	**NA**
Travel Time Savings	**251 hours per weekday**

Assessment

This is a medium-priority bus enhancement project. The capital cost for this project would be $53.1 million. The width of streets involved, their volume of general traffic handled and the impact on parking, would determine how practical it would be to install bus-only lanes or bus priority lanes on individual route segments. Capital costs could vary greatly from route to route. This assessment only used an average per mile cost for installing bus rapid transit on arterial streets. Improving travel times on the 10 busiest routes would have a modest total impact on ridership. There would be 3,000 additional bus riders of which 800 would be new transit riders. The cost effectiveness compared to other bus enhancement projects would be low, as the capital cost per new transit rider would be $68,100. There would be a neutral impact or slight reduction on operating costs, as it is assumed travel times would be reduced and vehicle requirements reduced or reinvested in more frequent service. Reliability would be improved through the use of priority lanes, signal prioritization, and Automatic Vehicle Locator systems providing real time vehicle location information to dispatchers, planners, and customers. Several of the routes proposed from enhancement serve neighborhoods which are targets for environmental justice.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Environ. Justice
Travel Time Improvement	◗	❍	❍	◗	◗	●

D PURCHASE 100 NEW BUSES

Description

The proposal calls for expanding the MBTA bus fleet by 100 vehicles. These additional buses would allow for improved service frequencies on 50 bus routes serving the inner 14 communities of the MBTA service area, including Boston. Routes projected to receive increased service are those with crowding problems, as well as routes operating infrequent service through neighborhoods with high density and high transit dependent populations. Service would be improved in both the peak and off-peak.

Capital Features

Purchase 100 buses.

Capital Cost	**$33.8 million**
Operating Cost	**$45,400 per weekday**
Daily Ridership Increase on Mode	**5,700**
Net Increase in Daily Transit Ridership	**1,400**
Capital Cost/New Transit Rider	**$23,600**
Operating Cost per Wkday/New Transit Rider	**$31.50**
Capital Cost/Travel Time Benefit	**$36,800 per hour**
Operating Cost/Travel Time Benefit	**$49.50 per hour**
Travel Time Savings	**918 hours per weekday**

Assessment

This is a medium-priority bus enhancement project. The capital cost for this project would be $33.8 million and the increase in typical daily operating costs would be $45,400. This project would attract 5,700 additional riders to urban bus routes, of which 1,400 would be new transit riders. The capital cost per new rider would be $23,600 and the operating cost per new rider would be $31.50. The cost effectiveness of this project would be moderate compared to other bus enhancement projects. There would be minimal air quality improvements associated with this project. This project would help reduce crowding conditions on existing bus routes and would provide improved service frequencies to a number of environmental justice target communities in the urban core. There would be a high increase in riders who are new to the mode, but only a moderate increase in new transit riders.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Environ. Justice
Frequency Improvement	●	❍	◗	❍	❍	●

D INSTALL A FOURTH TRACK ON THE FORT POINT CHANNEL BRIDGE

Description

This project would increase the capacity of the railroad bridges across Fort Point Channel near South Station. These bridges are used by all commuter trains on the Old Colony and Fairmount lines and by commuter and intercity train sets being shifted between South Station and yards on the opposite side of the channel for servicing or storage.

Capital Features

A fixed-span bridge about 200 feet long (excluding approaches) that would be built next to the existing railroad bridges over the channel.

Capital Cost	**$2.5 million**
Operating Cost	**Reduced delays could result in lower operating costs**
Daily Ridership Increase on Mode	**None**
Net Increase in Daily Transit Ridership	**None**
Capital Cost per New Transit Rider	**Not applicable**
Operating Cost per Wkday/New Transit Rider	**Not applicable**
Capital Cost/Travel Time Benefit	**Undetermined**
Operating Cost/Travel Time Benefit	**Undetermined**

Assessment

This project would increase the efficiency and reliability of commuter rail operations by reducing delays to trains waiting for clear tracks across Fort Point Channel. The savings are difficult to quantify without more detailed analysis of delays with present and anticipated future schedules. This project by itself would not expand transit access to any new residential or employment areas. It could, however, contribute to the feasibility of implementing new South Side commuter rail routes by helping to reduce congestion at the inner terminal. Overall this project is rated medium priority.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Environ. Justice
Frequency Improvement	NA	❍	NA	NA	◗	●

D INSTALL DOUBLE–TRACKING ON ENTIRE COMMUTER RAIL SYSTEM

Description

This project would install a second track on all segments of the commuter rail system that now have only one track.

Capital Features

A second track would be installed on approximately 125 route-miles that now have only one track. This would require some widening of bridges and relocation of platforms and crossing protection devices.

Capital Cost	**$398.3 million for track and signals only.**
Operating Cost	**Would depend on how service is changed after installation of second track.**
Daily Ridership Increase on Mode	**Undetermined**
Net Increase in Daily Transit Ridership	**Undetermined**
Capital Cost per New Transit Rider	**Undetermined**
Operating Cost per Wkday/New Transit Rider	**Undetermined**
Capital Cost/Travel Time Benefit	**Undetermined**
Operating Cost/Travel Time Benefit	**Undetermined**

Assessment

This project would increase the efficiency of commuter rail operations by reducing potential delays to trains waiting for single-track segments to be vacated. It would also increase flexibility in setting schedules, by reducing constraints on locations where one train can pass another. Such constraints affect both the possible schedules of trains traveling in opposite directions and those of local and express trains traveling in the same direction on a given line. The ridership and operating cost impacts would depend on how much service was changed as a direct result of the new scheduling possibilities. Currently, the longest segments of single track between passing tracks or double track include from Ipswich to Newburyport on the Newburyport Line (8.8 miles), from Reading to Andover Street (in Lawrence) on the Haverhill Line (13.6 miles), and from South Acton to Willows (in Ayer) on the Fitchburg Line (8.4 miles). The location of the single track on the Fitchburg Line would prevent operation of reverse-commuting service on the outer half of the line without disruption of present peak-direction service. Overall, the project is rated as medium priority.

Type of Project	Utilization	Mobility	Cost–Effectiveness	Air Quality	Service Quality	Environ. Justice
Frequency Improvement	NA	❍	NA	NA	◗	◗

D OPERATE EXPRESS SERVICE FROM OUTER STATIONS

Description

This project would implement new peak-period express trips on selected commuter rail lines. These trips would stop at several stations near the outer ends of their routes and then run non-stop to Boston. Some of these would run in addition to present local trains covering the full route. Others would replace full-route locals, with new short-turn local trains serving the inner stations.

Capital Features

A total of 15 new train sets would be needed in order to operate peak-period express service without elimination of other services.

Capital Cost	**$255.6 million**
Operating Cost	**$53,400 per weekday**
Daily Ridership Increase on Mode	**8,200**
Net Increase in Daily Transit Ridership	**3,000**
Capital Cost per New Transit Rider	**$84,100**
Operating Cost per New Transit Rider	**$17.60**
Capital Cost/Travel Time Benefit	**$171,500 per hour**
Operating Cost/Travel Time Benefit	**$35.60 per hour**
Travel Time Savings	**1,491 hours per weekday**

Assessment

This project would reduce trip times for passengers traveling to Boston from stations on outer segments of those commuter rail lines that now have track capacity for such added service. It would also reduce crowding on inner segments by diverting through riders from trains stopping at the inner stations. It would not increase the frequency of service at the inner stations, and would not necessarily increase frequency at the outer stations. Potential trip time reductions would be greatest on longer routes, such as the Fitchburg Line. In some cases where express service has been requested, such as on the Newburyport/Rockport Line between Beverly and Boston, present train frequency would permit express service only if some service to stations closer to Boston were eliminated. Overall, the capital and operating costs per new rider for express service additions would be in the mid-ranges of such costs among commuter rail projects analyzed. The capital costs relative to air quality improvements would also be in the mid-range among commuter rail projects. The overall rating of this project is medium priority.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Environ. Justice
Travel Time Improvement	●	❍	●	◗	❍	❍

OPERATE 4-CAR TRAINS ON GREEN LINE

Description

This project calls for the extension of platforms, purchase of additional rolling stock, expansion of maintenance facilities, and upgrades of power and signal systems necessary to operate four-car trains during peak periods on the Green Line. Presently, the maximum train length possible on the Green Line is three cars. The majority of Green Line trains are now two-car trains, but operation of additional three-car trains is anticipated for the future as ridership demand increases. This project would respond to capacity needs beyond that provided by three-car trains. Four-car trains would increase capacity by 30% over the already projected increased operation of three-car trains and would double capacity compared to existing two-car trains.

Capital Features

Purchase of additional vehicles, expansion of yard capacity, expansion of power system capacity, and extension of surface station platforms to accommodate four-car trains.

Capital Cost	**$339.4 million**
Operating Cost	**$267,700 per weekday**
Daily Ridership Increase on Mode	**4,100**
Net Increase in Daily Transit Ridership	**410**
Capital Cost/New Transit Rider	**$827,700**
Operating Cost per Wkday/New Transit Rider	**$653.00**
Capital Cost/Travel Time Benefit	**$2,921,400 per hour**
Operating Cost/Travel Time Benefit	**$2,304.70 per hour**
Travel Time Savings	**116 hours per weekday**

Assessment

This is a low-priority rapid transit enhancement project. The capital costs for this project would be $339.4 million and the increase in typical daily operating costs would be $267,700. This project would attract 4,100 riders to the mode of which 410 would be new transit riders. The capital cost per new transit rider would be $827,700 and the operating cost per new transit rider would be $653.00. As very few new riders would be attracted to the system with this enhancement, the project scores low for both capital and operating costs per new transit rider, compared to other rapid transit enhancement projects. Utilization receives a medium score compared to other rapid transit expansion projects, as crowding would be reduced but the number of new riders attracted and the impact on mode share would only be moderate. There would be little impact on air quality, as few riders would be attracted from automobiles. The projected ridership of the Green Line in 2025 exceeds the anticipated capacity provided by operating three-car trains. If no other projects are developed to divert ridership from the Green Line, it may be necessary to increase capacity in order to meet demand. The analysis of this project assumed the capital and operating cost of operating 100% 4-car trains during the peak on the entire Green Line network. Operating 4-car trains on only a portion of the Green Line network, or on only a limited number of trains would have lower capital costs than full implementation, and may be a strategy to investigate in future PMTs.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Environ. Justice
Facility Improvement	◗	❍	❍	❍	❍	●

SIGNAL AND TRAIN CONTROL IMPROVEMENTS ON GREEN LINE

Description

This proposal calls for making signal and train control improvements to the Green Line, which would provide a train control signal system with automatic stop features. The present Green Line signal system allows for very close spacing of trains up to 1.5 minutes apart, but does not provide automatic protection to prevent a train from entering an occupied signal block. This proposal calls for the installation of Communication Based Train Control (CBTC) equipment to provide this additional protection. There would most likely not be an increase in potential capacity from this installation because of the already close frequencies. Any signal installation which could not allow for 1.5-minute frequencies could actually reduce the capacity of the system.

Capital Features

Installation of new signal system.

Capital Cost	**$327.0 million**
Operating Cost	**No increase in operating costs**
Daily Ridership Increase on Mode	**0**
Net Increase in Daily Transit Ridership	**0**
Capital Cost/New Transit Rider	**No new riders**
Operating Cost per Wkday/New Transit Rider	**No change**
Capital Cost/Travel Time Benefit	**NA**
Operating Cost/Travel Time Benefit	**NA**

Assessment

This is a low-priority rapid transit enhancement project. The capital costs for this project would be $327 million. Because of the already close frequencies operated in the central subway of the Green Line, installation of a new signal system is not anticipated to result in any capacity improvements, and could result in capacity decreases compared to the current operating procedures. Such an installation would, however, have positive benefits for the safe and reliable operation of the system.

Present Green Line signal systems depend entirely on operator visual observations of wayside signals and do not have any automatic method to reduce speed or stop trains if signals are not followed correctly. Installation of a new signal system with automatic stop protection would reduce the chance of human error resulting in accidents.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Environ. Justice
Facility Improvement	❍	❍	❍	❍	◗	❍

CONSTRUCT COMMONWEALTH FLATS GRADE-SEPARATION PROJECT

Description

This proposal calls for extending the Silver Line bus tunnel under D St. This would reduce the amount of mixed-traffic operation required for Silver Line buses leaving World Trade Center station. Buses would avoid a stop light at the top of the transitway portal with this project.

Capital Features

Extend tunnel and relocate portal.

Capital Cost	**$70.0 million**
Operating Cost	**No increase in operating costs**
Daily Ridership Increase on Mode	**180**
Net Increase in Daily Transit Ridership	**100**
Capital Cost/New Transit Rider	**$700,000**
Operating Cost per Wkday/New Transit Rider	**No impact on operating costs**
Capital Cost/Travel Time Benefit	**$26,250,000 per hour**
Operating Cost/Travel Time Benefit	**(Travel time benefits not yet calculated)**
Travel Time Savings	**3 hours per weekday**

Assessment

This is a low-priority rapid transit enhancement project. This project would improve Silver Line reliability and improve travel times by reducing the amount of interface with automobile traffic at the D Street tunnel portal. The project would attract 180 new riders to the mode of which 100 would be new to transit. The capital cost per new transit rider would be very high at $700,000. However, there would be no anticipated increase in operating costs. The project would have little or no impact on utilization, mobility, air quality, or service quality. These results would likely change, though, upon full buildout of the South Boston waterfront. Indeed, the MBTA will continue to work with the city of Boston, Massport, and other interested parties to seek funding for this project in anticipation of such buildout.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Environ. Justice
Travel Time Improvement	❍	❍	❍	❍	❍	◗

❍ EXPAND THE WAITING AREA AT NORTH STATION

Description

This project would provide more room for passengers waiting to board trains at North Station.

Capital Features

An enlarged waiting area would be built, with amenities similar to those at South Station, including more benches, tables, food concessions, newsstands and other conveniences.

Capital Cost	**Undetermined**
Operating Cost	**No increase in operating costs**
Daily Ridership Increase on Mode	**Undetermined**
Net Increase in Daily Transit Ridership	**Undetermined**
Capital Cost per New Transit Rider	**Undetermined**
Operating Cost per Wkday/New Transit Rider	**NA**
Capital Cost/Travel Time Benefit	**NA**
Operating Cost/Travel Time Benefit	**NA**

Assessment

The present waiting area at North Station, which serves the majority of all North Side commuter rail passengers, is much smaller than that at South Station. It has few benches or concessions. The waiting area can become quite crowded, especially during P.M. peak hours. Patrons of events at the Fleet Center, which occupies the upper floors of the same building, must also enter through the station waiting room and line up to wait for the doors to open and pass through security checks. This often overlaps with peak commuting times. No significant permanent expansion of the present waiting room will be feasible until the privately owned property between the building in which it is located and Causeway Street is redeveloped. To some extent, daily commuters are able to time their trips to the station to minimize the amount of time spent in the waiting room. Overall, this project is rated low priority.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Environ. Justice
Facility Improvement	NA	❍	NA	NA	◗	❍

INCREASE SPEED AND FREQUENCY OF NEEDHAM SERVICE

Description

This project would reduce travel times to downtown Boston from stations on the outer end of the Needham Line and increase the frequency of service at those stations. This would be accomplished by running some peak-period express trains that by-pass stations in West Roxbury in addition to present local service.

Capital Features

At least four additional equipment sets would be needed to provide more frequent peak service.

Capital Cost	**$52.3 million**
Operating Cost	**$13,900 per weekday**
Daily Ridership Increase on Mode	**1,000**
Net Increase in Daily Transit Ridership	**230**
Capital Cost per New Transit Rider	**$227,500**
Operating Cost per Wkday/New Transit Rider	**$60.50**
Capital Cost/Travel Time Benefit	**$674,400 per hour**
Operating Cost/Travel Time Benefit	**$178.50 per hour**
Travel Time Savings	**78 hours per weekday**

Assessment

This project would make commuter rail service somewhat more convenient for passengers boarding at stations in Needham, but because of the present high transit share of trips from there, the potential for attracting new transit riders is limited. Because of this, the capital and operating costs per new transit rider would be among the highest for commuter rail projects analyzed for the PMT. At present, peak-period Needham Line trains are not overcrowded, especially when compared with trains on several of the other South Side lines. Overall, this project is rated low priority.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Environ. Justice
Frequency Travel Time Improvement	◗	❍	❍	❍	❍	❍

❍ BUILD NEW LAYOVER FACILITY IN BELLINGHAM FOR THE FRANKLIN LINE

Description

This project would increase the capacity for overnight storage of trains near the outer end of the Franklin Line by replacing or supplementing the existing Franklin layover facility with a new one in Bellingham.

Capital Features

Yard tracks and related equipment for secure storage of up to six trainsets would be built adjoining an existing rail freight line. About 2.5 miles of track and one grade crossing would need to be upgraded to allow trains to operate safely to the new facility, which would be located beyond the present end of passenger service at Forge Park.

Capital Cost	**$17.9 million**
Operating Cost	**Could increase or decrease depending on service strategy**
Daily Ridership Increase on Mode	**Undetermined**
Net Increase in Daily Transit Ridership	**Undetermined**
Capital Cost per New Transit Rider	**Undetermined**
Operating Cost per Wkday/New Transit Rider	**Undetermined**
Capital Cost/Travel Time Benefit	**Undetermined**
Operating Cost/Travel Time Benefit	**Undetermined**

Assessment

This project would improve the efficiency of operation of the Franklin Line by reducing the need to shift equipment between Boston and Forge Park at the beginning and end of the service day. This could either allow present service to be maintained at reduced cost or increased service to be run at less additional cost than would otherwise be incurred. The new facility would be compatible with, and essential for, a future extension of commuter rail service to Milford. Because it is possible to maintain present service without this facility, it is rated low priority overall.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Environ. Justice
Frequency Improvement	NA	❍	NA	NA	❍	❍

INSTALL PLATFORMS ON BOTH SIDES OF TRACKS AT STATIONS IN NEWTON

Description

This project would install platforms on the north side of the double-track Framingham/Worcester commuter rail line at the Newtonville, West Newton, and Auburndale stations. At present these stations have platforms on only the south side. Trains in both directions stopping at these stations must operate on the south track, and trains operating on the north track run non-stop through them.

Capital Features

A second platform would be installed at each of three stations. The new platforms would be wheelchair-accessible, and the present platforms would also be made accessible. Because of freight train clearance restrictions, the platforms would be mostly low-level, with mini-high-level platforms at the outer ends.

Capital Cost	**$5.2 million**
Operating Cost	**No increase in operating costs**
Daily Ridership Increase on Mode	**50**
Net Increase in Daily Transit Ridership	**10**
Capital Cost per New Transit Rider	**$522,100**
Operating Cost per Wkday/New Transit Rider	**Too small to calculate**
Capital Cost/Travel Time Benefit	**$5,221,000 per hour**
Operating Cost/Travel Time Benefit	**Too small to calculate**
Travel Time Savings	**1 hr/day**

Assessment

This project would allow some trains that now run non-stop past the three Newton stations to stop there. This would be advantageous mostly to reverse commuters traveling from Newton to points further out on the line, but there is very limited demand for such service. It would have little impact on the level of service provided for commuting between Newton and Boston. There is existing bus service to Boston from the same neighborhoods served by each of the three stations. At Auburndale and West Newton, substantial excavation would be needed in order to create space for platforms on the north side. At all three stations, both platforms would have to be made wheelchair-accessible. This would require installation of an elevator to each platform from the street. This would be one of the most costly commuter rail projects analyzed relative to the number of new transit riders attracted. Overall it is rated low priority.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Environ. Justice
Frequency Improvement	❍	❍	❍	◗	❍	❍

PURCHASE DIESEL MULTIPLE UNIT TRAINS TO ALLOW FOR INCREASED FREQUENCY ON COMMUTER RAIL LINES

Description

This project would bring the level of off-peak service up to at least hourly in both directions on all commuter rail lines that now have less frequent service than that. This would be done with Diesel Multiple Unit (DMU) cars because of their lower operating costs for trains requiring limited capacity. DMU cars are self-propelled and can operate as single units or in trains.

Capital Features

A total of 77 DMUs would be needed to run all present and added off-peak service with DMUs.

Capital Cost	**$264.4 million for 77 DMUs, excluding layover and servicing facilities.**
Operating Cost	**$7,500 per weekday**
Daily Ridership Increase on Mode	**800**
Net Increase in Daily Transit Ridership	**310**
Capital Cost per New Transit Rider	**$853,100**
Operating Cost per Wkday/New Transit Rider	**$24.20**
Capital Cost/Travel Time Benefit	**$3,347,500 per hour**
Operating Cost/Travel Time Benefit	**$95.00 per hour**
Travel Time Savings	**79 hours per weekday**

Assessment

This project would make commuter rail service more convenient for passengers traveling during off-peak hours, but operating cost savings of DMUs would not offset their high initial cost. Because off-peak ridership is relatively low, this would be one of the most costly commuter rail projects examined in terms of capital cost per new transit rider. At present, only one railcar manufacturer in the world offers a model of DMU that complies with current Federal Railroad Administration crash-safety standards. So far, only a single demonstrator car has been built, so there is no experience with actual operating and maintenance costs. No unit price for these cars has been announced. The capital cost above is based on an estimate of $3.4 million per car. Any model of DMU would be expected to require some specialized maintenance facilities. When not in use, each DMU would take up about the same amount of yard space as one standard coach. During late-night hours when no trains are run, adding a fleet of 77 DMUs to the present coach fleet would require an increase of over 20% in yard capacity. The MBTA already has a shortage of storage space for the existing equipment alone. Overall, this project is rated low priority. In the future, though, consideration could be given to the use of DMU's to provide connecting rail service on short spurs off of commuter rail main lines. This would be a strategy for expanding the reach of the commuter rail system without degrading frequency for existing passengers.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Environ. Justice
Frequency Improvement	◗	●	❍	❍	❍	◗

ELECTRIFY ALL COMMUTER RAIL LINES

Description

This project would electrify all MBTA commuter rail lines, and replace diesel locomotives on all trains with electric locomotives. This would allow faster acceleration and deceleration of trains and eliminate locomotive emissions.

Capital Features

With the present service network and track layout, a total of about 500 miles of track would need to be electrified, excluding yard tracks. (The Providence Main Line tracks are already electrified for intercity service, but MBTA trains on this line use diesels.) A total of 80 electric locomotives would be needed to operate the present number of trips on each line.

Capital Cost	**$2.0 billion**
Operating Cost	**Undetermined**
Daily Ridership Increase on Mode	**1,700**
Net Increase in Daily Transit Ridership	**900**
Capital Cost per New Transit Rider	**$2,227,000**
Operating Cost per Wkday/New Transit Rider	**Undetermined**
Capital Cost/Travel Time Benefit	**$5,982,900 per hour**
Operating Cost/Travel Time Benefit	**Undetermined**
Travel Time Savings	**335 hours per weekday**

Assessment

This project would result in average travel time savings of about five minutes per trip for each commuter rail passenger. Savings would not be uniformly distributed, and would range from about one minute on the shortest trips to about 12 minutes on the longest trips. The project would have high air quality benefits resulting from the elimination of locomotive emissions. Meanwhile, the number of auto trips eliminated would be only in the mid-range among commuter rail projects. It would be one of the most costly of all of the commuter rail projects examined for the PMT, both in absolute terms and relative to new transit ridership, to travel time savings, and to air quality improvements. Also, it would result in no measurable impacts on mobility or service quality. Overall, this project is rated low priority.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Environ. Justice
Travel Time Improvement	◗	❍	❍	●	❍	❍

ACCESSIBILITY ENHANCEMENTS

Introduction

The MBTA Key Station accessibility program for heavy rail/light rail and commuter rail lines is now nearly complete. The next phase of the program will provide accessibility to stations that were not included on the Key Station list. The PMT evaluations of accessibility projects are intended to help prioritize the order of the next stations to be made accessible, since resources would not permit all of them to be implemented simultaneously.

Stations on the Red, Orange, and Blue Lines all have high platforms, meaning platforms at the same height as vehicle floors. In general, accessibility improvements to such stations will consist of installing elevators to transport passengers between the platform levels and the streets outside the stations, and eliminating obstacles to wheelchair circulation within the stations. At stations with parking facilities, some modifications will be made to provide some number of accessible spaces.

Green Line stations and stops have low-level platforms, and Green Line cars have several interior steps. Low-floor cars being acquired for the Green Line have reduced floor heights at the center sections of the cars, but for technical reasons these are still several inches higher than the station platform heights that were used historically. Accessibility improvements to Green Line stations will include raising the platform heights to the level of the lower floor sections in the low-floor cars. Accessibility improvements to Green Line Central Subway stations, as at Red, Orange, and Blue Line stations, will include installation of elevators and removal of obstacles to wheelchair circulation. Platforms at surface stops on the B, C, and E Branches of the Green Line are entered directly from adjoining streets. Some stops on the D Branch are below street level, requiring construction of ramps at suitable grades for wheelchair access. Most Green Line stops do not include parking facilities. At those that do, some expansion of accessible parking may be needed in conjunction with the other improvements.

MBTA commuter rail cars are designed for boarding at either low-level or high-level platforms. At low-level platforms, passengers use stairs in the vestibules at the ends of each car. High-level platforms are the same height as the car vestibule floors. At stations with such platforms, the car stairwells are covered by trap doors. Accessibility improvements to commuter rail stations will include installation of full-length high-level platforms where technically feasible. At some locations, site constraints or clearance requirements for freight trains necessitate the use of mini-high-level platforms instead. The latter are located at one end of the station and are only one car length long. Depending on station layout, installation of full-length or mini-high-level platforms also requires installation of ramps or elevators to connect the platforms with adjacent ground height. Some changes in parking facilities may be needed to provide accessible spaces.

Station Ratings

The stations are listed in Table 5B-1, which also gives each station's rating.

Ratings for Individual Criteria

Ratings were given to each station for each of the evaluation criteria described below. In the table, a blank cell represents the lowest rating for that criterion, (no "credit" is given to the station with regard to that criterion). The icon ❍ represents a low rating (but one in which the station receives some "credit"), ◗ represents a medium rating, and ● represents a high rating.

Passenger Boardings

Stations with inbound boardings of 1,000 or higher were given a rating of ●. Stations with

inbound boardings between 500 and 999 were given a rating of ◗. Stations with inbound boardings between 100 and 499 were given a rating of ❍. Stations with less than 100 boardings were screened out of the evaluation unless they received at least one ❍ in another evaluation criterion.

Improvement of Transfers between Rail Lines

Stations were evaluated for providing connections between rail lines. All stations which serve as connecting points between rail lines are already designated as Key Stations.

Interconnectivity

Stations which are served by a single bus service (MBTA, private carrier, or regional transit authority) were given a rating of ❍. Stations served by multiple infrequent bus routes were given a rating of ◗. Stations served by multiple frequent bus routes were given a score of ●.

Terminal Locations

Stations which are terminals were given a rating of ●.

Service to Major Centers

Stations serving major activity centers, such as employment or government centers, institutions of higher education, hospitals or other major health care facilities, or other facilities that are major trip generators for persons with disabilities, were given a rating of ●.

Overall Ratings

The individual-criterion ratings were combined into overall ratings for each station, which translated into low, medium, and high priorities in the PMT. In the combining of ratings, a ❍ was considered to be equivalent to 1/3 of a ●, and 1/2 of a ◗. Stations with at least one ● rating and one ❍ rating (or an equivalent composite set of ratings) are considered to be a high priority. Other stations with at least one ◗ rating (or an equivalent composite set of ratings) are considered a medium priority. All remaining stations are low priorities.

TABLE 5B-1 ACCESSIBILITY ENHANCEMENT PROJECT RATING*

Station	Service	Inbound Ridership	In Process	Ridership	Rail Transfers	Inter-connectivity	Terminal Locations	Major Centers	Overall
Arlington	Green		●						●
Ashmont	Red-M		●						●
Babcock St	Green-B	1761		●				●	●
Blanford St	Green-B	2096		●				●	●
Boylston	Green	5934		●				●	●
Brighton Ave	Green-B	1571		●		❍			●
Brookline Hills	Green-D	2097		●				●	●
BU West	Green-B	899		◗				●	●
Charles	Red		●						●
Chelsea	CRR	257		❍		❍		●	●
Copley	Green		●						●
Fairmount	CRR		●						●
Fields Corner	Red		●						●
Franklin	CRR	1311		●		❍		●	●
Government Ctr	Green/Blue		●						●
Hynes ICA	Green	8579		●		◗		●	●
Kenmore	Green		●						●
Longwood	Green-D	2536		●				●	●
Malden	CRR		●						●
Malden	Orange		●						●
Mattapan	Red-M		●						●
Maverick	Blue		●						●
Newton Highlands	Green-D	1257		●		❍			●
Pleasant St	Green-B	1014		●				●	●
Rockport	CRR	215		❍		❍	●		●
St. Paul St	Green-B	814		◗				●	●
Savin Hill	Red		●						●
Science Park	Green	1360		●				●	●
Shawmut	Red		●						●
State	Blue		●						●
Symphony	Green-E	1065		●				●	●
Waltham	CRR	521		◗		◗			●
Wollaston	Red	4269		●		❍			●
Woodland	Green-D	1044		●		❍		●	●
Allston St	Green-B	1115		●					◗
Auburndale	CRR	376		❍		❍			◗
Back of the Hill	Green-E	86						●	◗
Beaconsfield	Green-D	896		◗					◗
Belmont	CRR	131		❍		❍			◗
Central Ave	Red-M	598		◗		❍			◗
Chestnut Hill	Green-D	1035		●					◗
Chestnut Hill Ave	Green-B	861		◗					◗
Chiswick Rd	Green-B	735		◗					◗
Eliot	Green-D	595		◗					◗
Englewood Ave	Green-C	585		◗					◗
Fairbanks	Green-C	500		◗					◗
Fordham Rd	Green-B	921		◗					◗
Griggs St	Green-B	1260		●					◗
Kent St	Green-C	510		◗					◗
Melrose Highlands	CRR	402		❍		❍			◗
Milton	Red-M	311		❍		❍			◗
Morton St	CRR	248		❍		❍			◗
Natick	CRR	960		◗		❍			◗
Newtonville	CRR	574		◗		❍			◗

*The rating icons are explained on page 5B-28 and 5B-29

TABLE 5B-1 ACCESSIBILITY ENHANCEMENT PROJECT RATING (CONT.)

Station	Service	Inbound Ridership	In Process	Ridership	Rail Transfers	Inter-connectivity	Terminal Locations	Major Centers	Overall
Sharon	CRR	1088		●					◗
St. Paul St	Green-C	886		◗					◗
Summit Ave	Green-B	583		◗					◗
Sutherland St	Green-B	923		◗					◗
Tappan St	Green-C	1020		●					◗
Uphams Corner	CRR	148		❍		❍			◗
Wakefield	CRR	679		◗		❍			◗
Walpole	CRR	865		◗		❍			◗
Warren St	Green-B	1629		●					◗
Waverly	CRR	127		❍		❍			◗
Wellesley Farms	CRR	535		◗					◗
Wellesley Hills	CRR	520		◗					◗
Wellesley Sq	CRR	790		◗					◗
West Medford	CRR	309		❍		❍			◗
West Newton	CRR	401		❍		❍			◗
Winchester	CRR	628		◗		❍			◗
Winchester St	Green-C	921		◗					◗
Windsor Gardens	CRR	552		◗					◗
Ayer	CRR	228		❍					❍
Brandon Hall	Green-C	360		❍					❍
Butler	Red-M	134		❍					❍
Cedar Grove	Red-M	110		❍					❍
Concord	CRR	439		❍					❍
Dean Rd	Green-C	316		❍					❍
Endicott	CRR	281		❍					❍
Fenwood St	Green-E	343		❍					❍
Greenwood	CRR	214		❍					❍
Greycliff Rd	Green-B	109		❍					❍
Hawes St	Green-C	426		❍					❍
Islington	CRR	226		❍					❍
Kendal Green	CRR	106		❍					❍
Lincoln	CRR	284		❍					❍
Littleton/495	CRR	146		❍					❍
Melrose Cedar Pk	CRR	285		❍					❍
Mount Hood Rd	Green-B	282		❍					❍
No. Leominster	CRR	208		❍					❍
No. Wilmington	CRR	180		❍					❍
Parker Hill	Green-E	462		❍					❍
Shirley	CRR	151		❍					❍
So. Acton	CRR	466		❍					❍
South St	Green-B	237		❍					❍
Waban	Green-D	427		❍					❍
Wedgmere	CRR	324		❍					❍
Wyoming Hill	CRR	196		❍					❍

ACCESS TO SERVICE

Over the last decade, public attention has centered on the lack of adequate parking supply to meet the growing demand for automobile access to MBTA services. This focus can be attributed in large part to the Central Artery/Tunnel Project mitigation that required the MBTA to increase parking by 20,000 spaces throughout the system. Expansion of the commuter rail system has also produced further demand for parking. Today, many communities continue to pursue parking initiatives with the MBTA to meet the needs of their residents. However, the focus on automobile parking has overshadowed other transportation modes that MBTA customers use to access the Authority's services.

Across the entire MBTA system, 84% of riders bicycle or walk to stations. This mode share suggests more attention should be given to types of access other than the automobile. Increasingly, transportation policy makers and the riding public have generated support for a "balanced" station access analysis for all modes. Their typical interests are in travel time, cost, convenience, safety and congestion reduction. This PMT reflects the importance of automobile parking to the region, but it also addresses the need to further promote other access modes to transit.

Automobile Parking

In the commuter rail system, 54% of users drive to stations to access service. Clearly, automobile parking is a critical access mode for the MBTA system. Because communities are so different, the MBTA has developed a process to analyze the large number of parking projects that are currently under consideration. The PMT has incorporated this evaluation process to ensure that past work informs this new parking prioritization.

Project Screening

Every commuter rail, commuter boat, and heavy rail/light rail station in the system was preliminarily reviewed based on information available at the MBTA or the Central Transportation Planning Staff. Stations that lack elements necessary for project development, including available property for expansion and municipal support, were made low priorities. A low prioritization was also assigned to stations where an expansion was completed within the last ten years or is currently underway.

Station Ratings

Ratings were applied with respect to the following evaluation criteria for most commuter rail stations, heavy rail/light rail stations, and boat terminals included in the prescreened parking facility expansion project listing:

- **Customer Access**—Quality of automobile access to the station parking lot from major arterial roadways
- **Land/Air Rights**—MBTA ownership of (or access to) land and/or air rights for expansion of the parking facility
- **Projected Demand**—Magnitude of expected future demand for parking at the station
- **Potential Utilization**—Ability of potential parking expansion to meet the needs of projected demand
- **Cost per Parking Space**—Expected cost per parking space, either in surface lot or garage
- **Environmental Status**—Barriers to parking expansion resulting from existing environmental issues
- **Ease of Construction**—Barriers to parking expansion resulting from space constraints, land acquisition issues, challenging terrain, etc.

- **Community Support**—Level of support demonstrated by local and/or regional officials and community groups for expansion of the parking facility

- **Funding Availability**—Availability of non-MBTA funding sources for expansion of the parking facility

For each criterion, a high rating is signified by a ●. A medium rating is signified by a ◗, and a low rating is signified by a ❍. “NA” means not applicable. The individual-criterion ratings were then combined into overall ratings for each station, which translated into low ❍, medium ◗, and high ● priorities for the PMT. When combining ratings, a ❍ was considered to be equivalent to 1/3 of a ●, and 1/2 of a ◗.

Stations with at least four ● ratings and five ◗ ratings (or an equivalent composite set of ratings) are considered to be a high priority for implementation. Other stations with at least nine ◗ ratings (or an equivalent composite set of ratings) are considered a medium priority. All remaining stations are a low priority.

Individual-criterion ratings were not applied to stations where parking facilities are currently being expanded or are planned for expansion, or where substantial community opposition exists to potential expansion projects. Each of these stations was instead classified as low priority for implementation, overall. Project ratings are shown in table 5B-2.

Shuttles

Housing and employment development beyond the Route 128 corridor has created demand for nontraditional transportation services. Chapter 3, which discussed the region’s mobility challenges, details the demand for new and expanded transit choices for suburban commuters. Shuttle transportation is often regarded as a viable alternative. The PMT has analyzed the potential for such service. Because some shuttle routes are long enough to be considered system expansion projects, the shuttle projects are presented in Chapter 5C.

Bicycle/Pedestrian

Chapter 2 details improvements that the MBTA has made to the Bikes-on-the-T Program over the last several years. These changes have expanded upon the MBTA’s standing policy to provide bicycle parking as part of any station improvement project. Together, these efforts have resulted in some enhancements to bicycle access to the MBTA system. However, with the preponderance of MBTA customers accessing service by walking or bicycling, the Authority is strengthening its focus on promoting and improving these access modes. The overall ratings assigned to bicycle and pedestrian systemwide access projects in the PMT echo the importance of these service enhancements (see pages 5B-37 - 5B-40). These access modes are also significant due to eastern Massachusetts’s highway congestion problems and the Commonwealth’s constrained financial condition.

To implement these priorities, the MBTA is working with the Executive Office of Transportation and Construction (EOTC) and the Massachusetts Highway Department (MassHighway) to analyze bicycle and pedestrian access to MBTA stations. This project will evaluate approximately twenty stations and will estimate the demand for bicycle and pedestrian access to these sites. The analysis will assess current conditions, which will serve as the basis for recommended improvements at these stations. Once improvements are implemented, an evaluation will be performed to determine the success of the station enhancements.

Unlike automobile parking projects, the MBTA does not have specific criteria to prioritize individual bicycle and pedestrian projects, and few such projects were introduced during the public process for the PMT. This MBTA/EOTC/MassHighway initiative will provide the information necessary to better evaluate such improvements in future updates of the PMT and will facilitate comparisons between all access modes to MBTA service.

The MBTA is also continuing to work with other interested parties to consider ways to

expand bicycle parking systemwide, including the increased use of lockers and the potential for a bicycle station. Assessments of bicycle and pedestrian enhancement projects, along with other access-to-service projects are shown on the pages following Table 5B-2. In the ratings of these projects by individual criteria, the meanings of the icons are the same as has been explained for the General Enhancements, as are the values assigned to those ratings when combining them to produce an overall rating.

TABLE 5B-2 PARKING ENHANCEMENT PROJECT RATING*

Station	Service	Cust. Access	Land/ Air Rights	Proj. Dem	Pot. Util.	Cost Per Pkg Space	Envir. Status	Ease of Constr.	Comm. Supp.	Fund. Avail.	Over-all
Beverly Depot	CRR	●	●	●	◗	◗	◗	●	●	◗	●
Bridgewater	CRR	◗	●	●	●	●	●	◗	●	◗	●
Fitchburg	CRR	◗	●	❍	●	●	◗	◗	●	●	●
Forge Park	CRR	◗	●	●	●	◗	●	◗	◗	◗	●
Franklin	CRR	❍	●	◗	●	●	●	◗	●	◗	●
Kingston	CRR	◗	●	●	●	●	●	◗	◗	◗	●
Lawrence	CRR	◗	●	◗	●	◗	◗	●	●	●	●
Natick	CRR	◗	●	◗	●	●	◗	●	●	◗	●
No. Quincy	Red-B	◗	●	●	❍	●	●	◗	●	◗	●
Quincy Adams	Red-B	●	●	●	●	●	●	◗	◗	◗	●
Salem	CRR	●	●	●	●	◗	◗	●	●	●	●
So. Attleboro	CRR	●	●	●	●	◗	●	◗	●	●	●
Whitman	CRR	●	●	◗	●	●	◗	●	●	◗	●
Woodland	Green-D	◗	●	●	❍	◗	●	●	●	●	●
Abington	CRR	◗	❍	●	●	❍	●	●	◗	◗	◗
Attleboro	CRR	◗	●	●	●	❍	❍	❍	●	●	◗
Devens-Shirley	CRR	◗	◗	◗	●	●	◗	◗	❍	●	◗
Gloucester	CRR	◗	●	❍	●	❍	◗	◗	●	●	◗
Hingham	Boat	◗	◗	●	●	●	◗	◗	◗	◗	◗
Littleton	CRR	●	●	◗	◗	◗	●	◗	◗	◗	◗
Mansfield	CRR	◗	●	●	❍	❍	◗	◗	●	●	◗
Milton	Red-M	◗	◗	❍	◗	◗	●	●	●	●	◗
Norfolk	CRR	❍	●	●	●	●	●	◗	❍	◗	◗
No. Leominster	CRR	◗	●	❍	◗	◗	◗	◗	●	●	◗
Rockport	CRR	◗	●	❍	●	❍	◗	◗	●	◗	◗
So. Weymouth	CRR	◗	❍	●	●	◗	◗	●	◗	◗	◗
Walpole	CRR	◗	◗	●	●	❍	❍	◗	●	◗	◗
Alewife	Red										❍
Anderson RTC	CRR										❍
Andover	CRR										❍
Ashland	CRR										❍
Auburndale	CRR										❍
Ayer	CRR	◗	❍	◗	❍	◗	❍	❍	●	❍	❍
Ballardvale	CRR										❍
Brockton	CRR										❍
Campello	CRR										❍
Canton Junction	CRR										❍
Dedham Corp. Ctr	CRR										❍
Forest Hills	CRR										❍
Framingham	CRR										❍
Grafton	CRR										❍
Halifax	CRR										❍
Hamilton/ Wenham	CRR										❍
Hanson	CRR										❍
Haverhill	CRR										❍
Holbrook/ Randolph	CRR										❍
Hyde Park	CRR	❍	❍	◗	●	❍	❍	◗	❍	❍	❍
Kendal Green	CRR										❍
Lincoln	CRR	◗	●	◗	❍	◗	❍	◗	◗	◗	❍
Lowell	CRR										❍
Malden Center	CRR										❍

*The rating icons are explained on page 5B-33

TABLE 5B-2 PARKING ENHANCEMENT PROJECT RATING (CONT.)

Station	Service	Cust. Access	Land/ Air Rights	Proj. Dem.	Pot. Util.	Cost Per Pkg. Space	Envir. Status	Ease of Constr.	Comm. Supp.	Fund. Avail.	Over-all
Malden Center	Orange										❍
Middleborough/ Lakeville	CRR										❍
Montello	CRR										❍
Needham Hghts.	CRR										❍
Needham Junct.	CRR										❍
Newburyport	CRR										❍
North Billerica	CRR										❍
Norwood Ctr.	CRR										❍
Norwood Depot	CRR										❍
Readville	CRR										❍
Route 128	CRR										❍
Rowley	CRR										❍
Sharon	CRR										❍
South Acton	CRR										❍
Southborough	CRR										❍
Stoughton	CRR										❍
Wellesley Sq	CRR										❍
Wellington	Orange										❍
West Medford	CRR	❍	◗	◗	❍	◗	◗	❍	●	◗	❍
West Natick	CRR										❍
Westborough	CRR										❍
Wilmington	CRR										❍
Winchester	CRR	❍	●	◗	●	◗	◗	❍	❍	◗	❍
Wollaston	Red-B										❍
Woodland	Green-D										❍
Worcester	CRR										❍

IMPROVE PEDESTRIAN ACCESS TO ALL RAPID TRANSIT AND COMMUTER RAIL STATIONS

Description

This project would improve walking paths to commuter rail and rapid transit stations throughout the system to facilitate walking as a means of station access and egress.

Capital Features

Improvements would be designed on a station-by station basis, and would include such features as new or upgraded sidewalks, improved lighting, and pedestrian lights at busy street intersections. Most improvements would take place within a one-mile radius of a station.

Capital Cost	**Undetermined**
Operating Cost	**See discussion in assessment below**
Daily Ridership Increase on Mode	**Undetermined**
Net Increase in Daily Transit Ridership	**Undetermined**
Capital Cost per New Transit Rider	**Undetermined**
Operating Cost per Wkday/New Transit Rider	**Undetermined**
Capital Cost/Travel Time Benefit	**Undetermined**
Operating Cost/Travel Time Benefit	**Undetermined**

Assessment

Overall, this project is rated high priority. Improvements to pedestrian access can result in increased ridership without costly expansion of parking facilities. To the extent that passengers walking to stations are diverted from private autos, walking access improvements can contribute to improved air quality. Pedestrian improvements have no vehicle operating costs, but walkways do need to be maintained and kept clear of snow and debris. In addition, lighting systems have costs for electric power and maintenance. In some locations, pedestrian safety may require deployment of traffic officers at busy intersections. Because of population density and distribution, most stations would still have to allow for means of access other than walking regardless of the quality of walking paths. Few passengers will take the time to walk more than one mile to or from a station on a regular basis, and not all who would have walking paths of under one mile will choose to walk.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Environ. Justice
Access Improvement	NA	❍	NA	NA	●	●

D

IMPROVE PEDESTRIAN ACCESS TO ANDERSON RTC FROM WESTERN SIDE OF TRACKS

Description

This project would provide safe and direct pedestrian access to the Anderson Regional Transportation Center Station on the Lowell commuter rail line in Woburn from the west side of the tracks.

Capital Features

A pedestrian bridge over the inbound track, connecting Boston Street with the center island platform, or a combined pedestrian and vehicular bridge from Boston street to the station parking lot would be built.

Capital Cost	**$1.6 million**
Operating Cost	**No increase in operating costs**
Daily Ridership Increase on Mode	**40**
Net Increase in Daily Transit Ridership	**20**
Capital Cost per New Transit Rider	**$77,700**
Operating Cost per Wkday/New Transit Rider	**NA**
Capital Cost/Travel Time Benefit	**$776,900 per hour**
Operating Cost/Travel Time Benefit	**NA**
Travel Time Savings	**2 hours per weekday**

Assessment

This project would reduce the access distance to the station by three miles or more for some passengers starting from points on the west side. The number that could take advantage of this improvement is fairly small, but the capital cost would also be small, making this one of the more cost-effective projects analyzed. A pedestrian bridge would also improve access to some light industrial development to the west side of the rail line. This station is well served by trains suitable for reverse commuting, so the bridge would expand employment opportunities within walking distance of the station. Overall, this project is rated medium priority.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Environ. Justice
Access Improvement	❍	◗	●	◗	◗	◗

D INSTALL BIKE RACKS AT RAPID TRANSIT AND COMMUTER RAIL STATIONS

Description

This project would provide new or improved bicycle parking facilities at commuter rail and rapid transit stations throughout the system to facilitate bicycle riding as a means of station access and egress.

Capital Features

Improvements would be designed on a station-by station basis, and could range from simple open-air racks to fully-enclosed lockers.

Capital Cost	**$40,000 (for minimum facilities)**
Operating Cost	**See discussion in assessment below**
Daily Ridership Increase on Mode	**Undetermined**
Net Increase in Daily Transit Ridership	**Undetermined**
Capital Cost per New Transit Rider	**Undetermined**
Operating Cost per Wkday/New Transit Rider	**Undetermined**
Capital Cost/Travel Time Benefit	**Undetermined**
Operating Cost/Travel Time Benefit	**Undetermined**

Assessment

Overall, this project is rated medium priority. Improvements to bicycle parking facilities can result in increased ridership without costly expansion of automobile parking facilities. The cost to install a six-foot open-air bicycle rack at every rapid transit and commuter rail station that does not currently have any bicycle racks would be about $40,000. This would provide limited lock-up capacity, with no protection from weather, vandalism, or theft. To the extent that passengers bicycling to stations are diverted from private autos, bicycle parking improvements can contribute to improved air quality. Bicycle parking facilities have no vehicle operating costs, but racks or lockers do need to be kept in a state of good repair in order to attract users. To make use of bicycle parking facilities, passengers must be able to reach stations safely by bicycle, so the broader issue of bicycle routes must be considered when prioritizing sites for bicycle parking.

Type of Project	Utilization	Mobility	Cost–Effectiveness	Air Quality	Service Quality	Environ. Justice
Access Improvement	NA	❍	NA	NA	◗	●

D INSTALL MORE ENCLOSED WAITING AREAS ALONG MBTA LINES

Description

This project add more shelters at commuter rail and rapid transit stations.

Capital Features

Improvements would be designed on a station-by station basis, and would depend on typical ridership volumes and on the extent to which shelters are already provided.

Capital Cost	**Undetermined**
Operating Cost	**See discussion in assessment below**
Daily Ridership Increase on Mode	**Undetermined**
Net Increase in Daily Transit Ridership	**Undetermined**
Capital Cost per New Transit Rider	**Undetermined**
Operating Cost per Wkday/New Transit Rider	**Undetermined**
Capital Cost/Travel Time Benefit	**Undetermined**
Operating Cost/Travel Time Benefit	**Undetermined**

Assessment

Overall, this project is rated medium priority. Improvements to waiting facilities at stations can encourage greater use of transit lines and improve service for passengers already using the lines. To the extent that providing shelters induces passengers to shift to transit from private autos, this can help improve air quality. Shelters have no vehicle operating costs, but must be cleaned and maintained to remain attractive. Shelters are only one component of the overall transit experience, which must also include adequate capacity on the transit vehicles and adequate means of access to stations.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Environ. Justice
Access Improvement	NA	❍	NA	NA	●	◗

❍ ADD BIKE RACKS TO COMMUTER RAIL COACHES

Description

This project would provide specially equipped areas within commuter rail coaches for transportation of bicycles.

Capital Features

Bicycle racks and tie-down devices would be provided in a certain number of coaches on all commuter rail trains. In some cases this would require replacement of some existing non-moveable seats with flip-up seats.

Capital Cost	**Undetermined**
Operating Cost	**No increase in operating costs**
Daily Ridership Increase on Mode	**Undetermined**
Net Increase in Daily Transit Ridership	**Undetermined**
Capital Cost per New Transit Rider	**Undetermined**
Operating Cost per Wkday/New Transit Rider	**None**
Capital Cost/Travel Time Benefit	**NA**
Operating Cost/Travel Time Benefit	**NA**

Assessment

This project would make commuter rail travel more convenient for passengers that want or need to use bicycles for both access to and egress from trains. It could also be helpful for reverse-commuters going to jobs that are beyond walking distance of the nearest rail stations and to which no connecting transit service is provided. There is little information from which to estimate the number of riders that would take advantage of on-train bike racks. Survey results indicate that under 0.5% of MBTA commuter rail riders use bicycles for access to their initial boarding stations. This proportion is lower than it might be if bicycles could be brought on board trains or parked at more secure facilities at stations. On-board bicycle racks could result in some reduction of the number of seats on equipped cars. Overall, this project is rated low priority.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Environ. Justice
Access Improvement	NA	❍	NA	NA	◗	❍

❍ ADD MORE MOTORCYCLE PARKING SPACES SYSTEMWIDE

Description

This project would designate some spaces specifically for motorcycle parking at commuter rail and rapid transit stations.

Capital Features

Improvements would be designed on a station-by station basis, and could consist either of re-striping and new signage in sections of existing parking areas or of construction of new spaces specifically for motorcycles.

Capital Cost	**Undetermined**
Operating Cost	**See discussion in assessment below**
Daily Ridership Increase on Mode	**Undetermined**
Net Increase in Daily Transit Ridership	**Undetermined**
Capital Cost per New Transit Rider	**Undetermined**
Operating Cost per Wkday/New Transit Rider	**Undetermined**
Capital Cost/Travel Time Benefit	**Undetermined**
Operating Cost/Travel Time Benefit	**Undetermined**

Assessment

Overall, this project is rated low priority. Improvements to motorcycle parking facilities can result in increased ridership at a lower cost than expansion of automobile parking facilities because several motorcycles can be parked in the same amount of space as one automobile. However, the year-round demand for motorcycle parking at transit stations is quite low. Motorcycle parking facilities have no vehicle operating costs other than those paid by the riders, but they do need to be kept in a state of good repair in order to attract users. Passengers accessing stations by motorcycle would use the same roads as passengers arriving by auto.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Environ. Justice
Access Improvement	NA	❍	NA	NA	❍	◗

CHAPTER 5C

System Expansion

System expansions are projects that would extend a transit line to an area it does not currently serve, implement service on an existing line at a time of day when it is not currently provided, or change the mode of transportation operated on an existing route. The assessments of expansion projects in this chapter are divided into two groups: projects within Massachusetts and multistate projects. The latter consist mostly of commuter rail extensions crossing into New Hampshire or Rhode Island that would require cooperative capital funding agreements with those states. The North-South Rail Link in Boston is also classified as a multistate project, as it would be used by interstate passenger trains in addition to commuter trains.

The evaluation criteria used in the project assessments have been discussed in Chapter 1. The ratings for each project for each of these criteria are shown at the bottom of the assessment page for that project. A ● indicates a high rating, a ◗ indicates a medium rating, and a ❍ indicates a low rating. An overall rating based on a composite of the ratings for all of the evaluation criteria appears at the top of the same page. For the overall ratings the icons meanings are as follows:

- ● High priority
- ◗ Medium priority
- ❍ Low priority

The individual-criteria ratings for each project were based on performance relative to other projects being evaluated within the same mode only. For this purpose, projects were divided into four modes: rapid transit (including the Red, Orange, Blue, Green, and Silver Lines, and Phase 2 and 3 Urban Ring), commuter rail, bus/trackless trolley, and boat. In combining individual-criterion ratings to produce its overall rating, a ❍ was considered to be equivalent to 1/3 of a ●, and 1/2 of a ◗.

The projects within Massachusetts are presented first, followed by multistate projects. Within each of these groups, the order of presentation is from high priority to medium priority to low priority. In each priority category, projects are grouped according to the four modes described above. Key cost and ridership estimates are included with each assessment. Additional details on other quantitative indicators for each project are included in Appendix C.

Expansion Projects within Massachusetts

MAP 5C-1 EXTEND BLUE LINE FROM WONDERLAND TO LYNN

EXTEND BLUE LINE FROM WONDERLAND TO LYNN

Description

This project would extend the Blue Line rapid transit line 4.5 miles from Wonderland Station in Revere to Central Square, Lynn. The alignment would either be parallel to the Newburyport/Rockport commuter rail line or it would make use of the abandoned narrow gauge right of way through Oak Island Center and Point of Pines Center. The MBTA is currently evaluating these options as part of its Draft Environmental Impact Statement (DEIS) for the Revere to Salem corridor. The DEIS will provide additional details on the relative benefits of each alignment. The extension would also include a crossing of the Saugus River, which is a navigable waterway. Consequently, a bridge there would need to accommodate both large vessels on the river and high-frequency rapid transit service. It should be noted that this extension of the Blue Line is intended to complement – not replace – existing commuter rail service to the North Shore.

Capital Features

Rapid Transit line extension including a major river crossing, possible wetlands mitigation requirements, two potential new stations, and purchase of additional Blue Line vehicles.

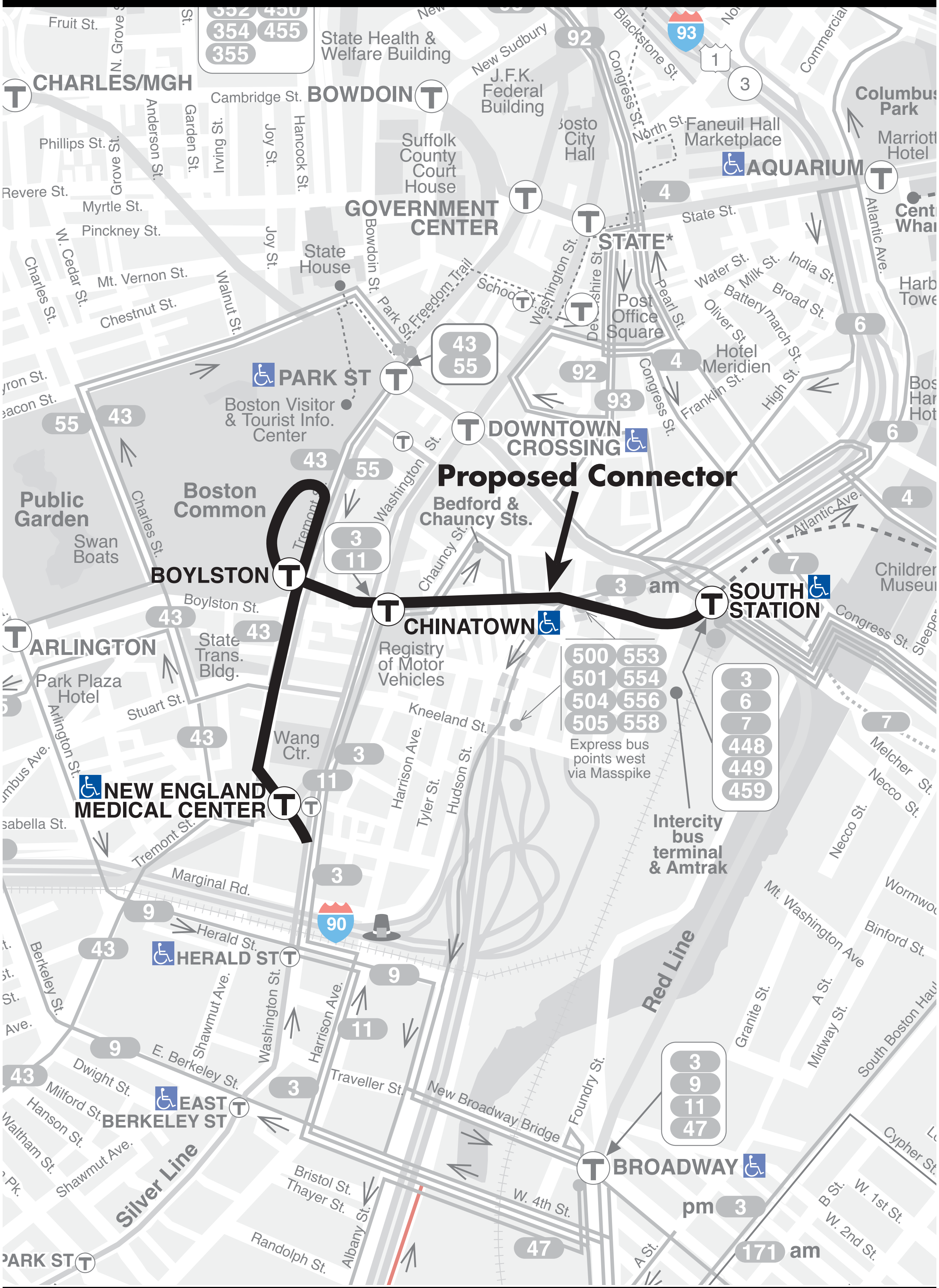
Capital Cost	**$357.6 million (CTPS estimate)**
Operating Cost	**$72,500 per weekday**
Daily Ridership Increase on Mode	**21,000**
Net Increase in Daily Transit Ridership	**7,900**
Capital Cost/New Transit Rider	**$45,300**
Operating Cost per Wkday/New Transit Rider	**$9.20**
Capital Cost/Travel Time Benefit	**$355,800 per hour**
Operating Cost/Travel Time Benefit	**$72.10 per hour**
Travel Time Savings	**1005 hours per weekday**

Assessment

This is a high priority rapid transit expansion project. The capital cost for the project would be $357.6 million and the typical daily operating cost would be $72,500. Extending Blue Line service to Lynn would attract 21,000 new rapid transit riders of which 7,900 would be new transit riders. The remaining 13,100 would be diverted from MBTA bus routes and from the Rockport/Newburyport commuter rail line. The capital cost per new transit rider would be just over $45,000 and the operating cost per new rider would be $9.20. The extension is expected to have major land use and economic impacts on Lynn, particularly in the downtown area, which is a state designated revitalization area with substantial commercial and residential development. Lynn is considered a target area for projects providing environmental justice. Service quality would improve for those passengers now riding MBTA bus service in the area, as transfers would be reduced, travel times to Boston would be improved compared to the bus mode, and frequency of service would be greatly expanded. The extension would provide for transfers between the Newburyport/Rockport commuter rail line and the Blue Line at Lynn Station, and improve access to Logan Airport from locations on the North Shore.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Economic/ Land Use Impacts	Environ. Justice
Line Extension	●	◗	◗	●	◗	●	●

MAP 5C-2 SILVER LINE PHASE III: SOUTH STATION – BOYLSTON CONNECTOR



SILVER LINE PHASE III: SOUTH STATION–BOYLSTON CONNECTOR

Description

This project would construct a new transitway tunnel from South Station to New England Medical Center station with intermediate stops at Boylston and Chinatown stations. The segment would link Phase 1 of the Silver Line, which runs between New England Medical Center and Dudley, with Phase 2 from South Station to Logan Airport via the World Trade Center. The Phase III segment would also allow for direct transfers from all segments of the combined Silver Line with the Red Line, Orange Line, and Green Line. Silver Line Phase III is an ACO legal commitment (see table 2-2).

Capital Features

Construction of a transitway tunnel with three new underground stations at major transfer points with other rapid transit lines. Purchase of additional dual-mode vehicles.

Capital Cost	**$951.9 million (MBTA Planning Dept. estimate)**
Operating Cost	**$2,600 per weekday**
Daily Ridership Increase on Mode	**20,500**
Net Increase in Daily Transit Ridership	**4,500**
Capital Cost/New Transit Rider	**$210,600**
Operating Cost per Wkday/New Transit Rider	**$0.60**
Capital Cost/Travel Time Benefit	**$386,700 per hour**
Operating Cost/Travel Time Benefit	**$1.00 per hour**
Travel Time Savings	**2,462 hours per weekday**

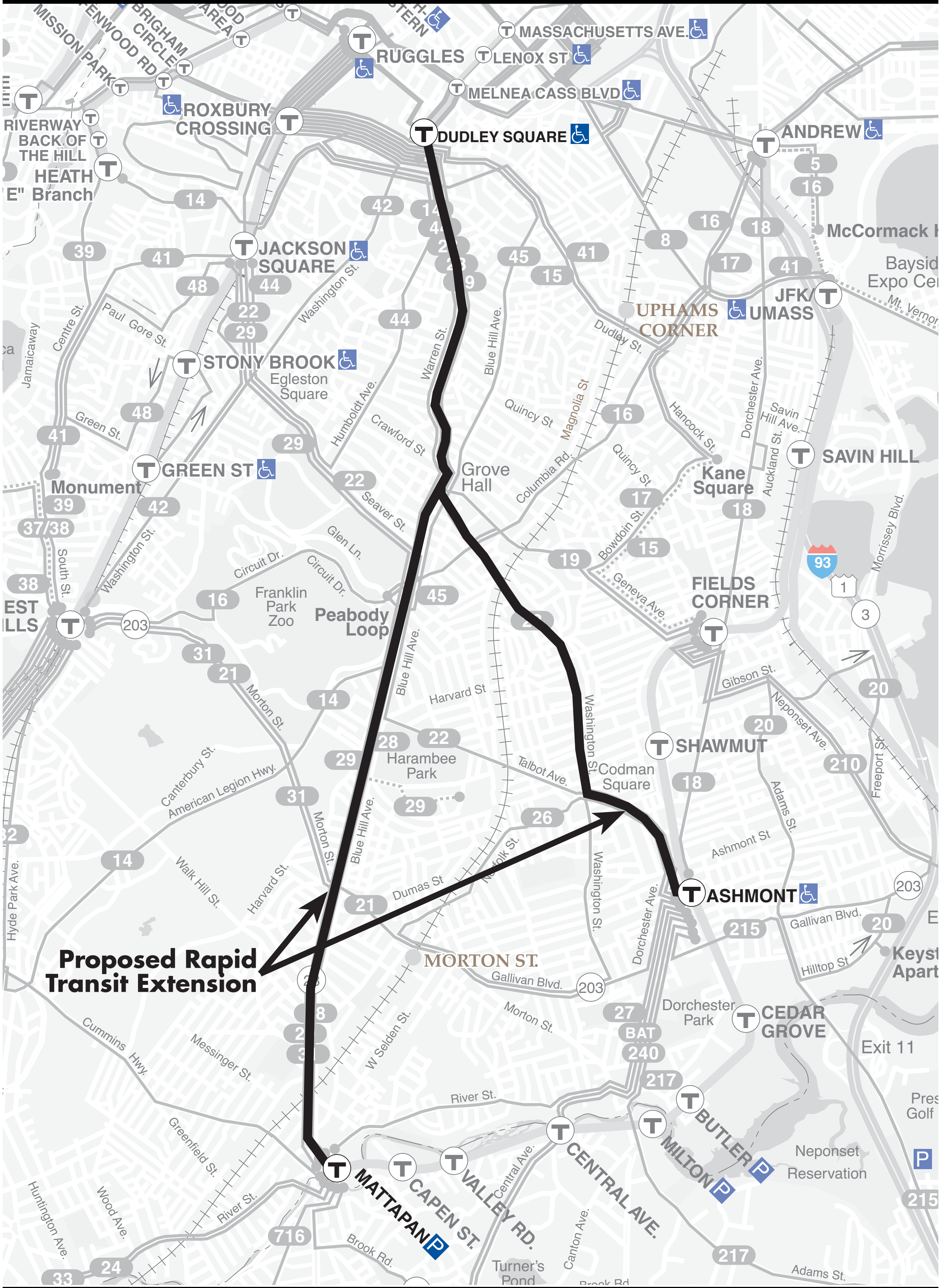
Assessment

This is a high priority rapid transit expansion project. The capital cost for this project would be $951.9 million. This figure is a planning level estimate that includes 50% contingency and inflation based on a projected year of expenditure with completion by 2010. The typical daily operating cost would be $2,600. This project would connect two disconnected segments of the Silver Line and created one through route between Roxbury, Downtown, South Boston, and Logan Airport. The project would attract 20,500 passengers to the mode of which 4,500 would be new transit riders. This project would result in a moderate reduction in air pollution. The anticipated high construction costs result in moderate cost effectiveness per new transit rider despite drawing a large number of new riders. Because the segment of new construction is short and would also result in a combination of two planned or existing services, the operating cost per new passenger would be very low.

The project would provide improved access and connections to the South Boston Waterfront area, which is expected to be an area of high employment growth and mixed use development with residential areas, and would provide improved access from residential areas in Roxbury which are a high priority for environmental justice. Direct transfers would be provided to the Green Line, Orange Line, and the Red Line.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Economic/ Land Use Impacts	Environ. Justice
Line Extension	●	●	◗	◗	◗	●	●

MAP 5C-3 SILVER LINE SOUTH EXTENSION TO ASHMONT AND MATTAPAN



SILVER LINE SOUTH EXTENSION TO ASHMONT AND MATTAPAN

Description:

This project would extend Silver Line bus rapid transit service beyond Dudley station to Ashmont and Mattapan. Service would follow Warren Street from Dudley to Grove Hall, and would then split into two branches. One branch would be 4.4 miles in length (including the segment between Dudley and Grove Hall) and continue on Blue Hill Avenue to Mattapan station, and the other would be 3.5 miles long and continue along Washington Street to Ashmont. These branches would replace present MBTA bus Routes 23 and 28. Bus priority lanes and sheltered stops containing passenger information would be constructed along the route. ITS technology would be used to monitor and regulate service.

Capital Features

Construction and installation of dedicated bus lanes, priority signals, and passenger shelters with amenities. Purchase of additional dual-mode buses.

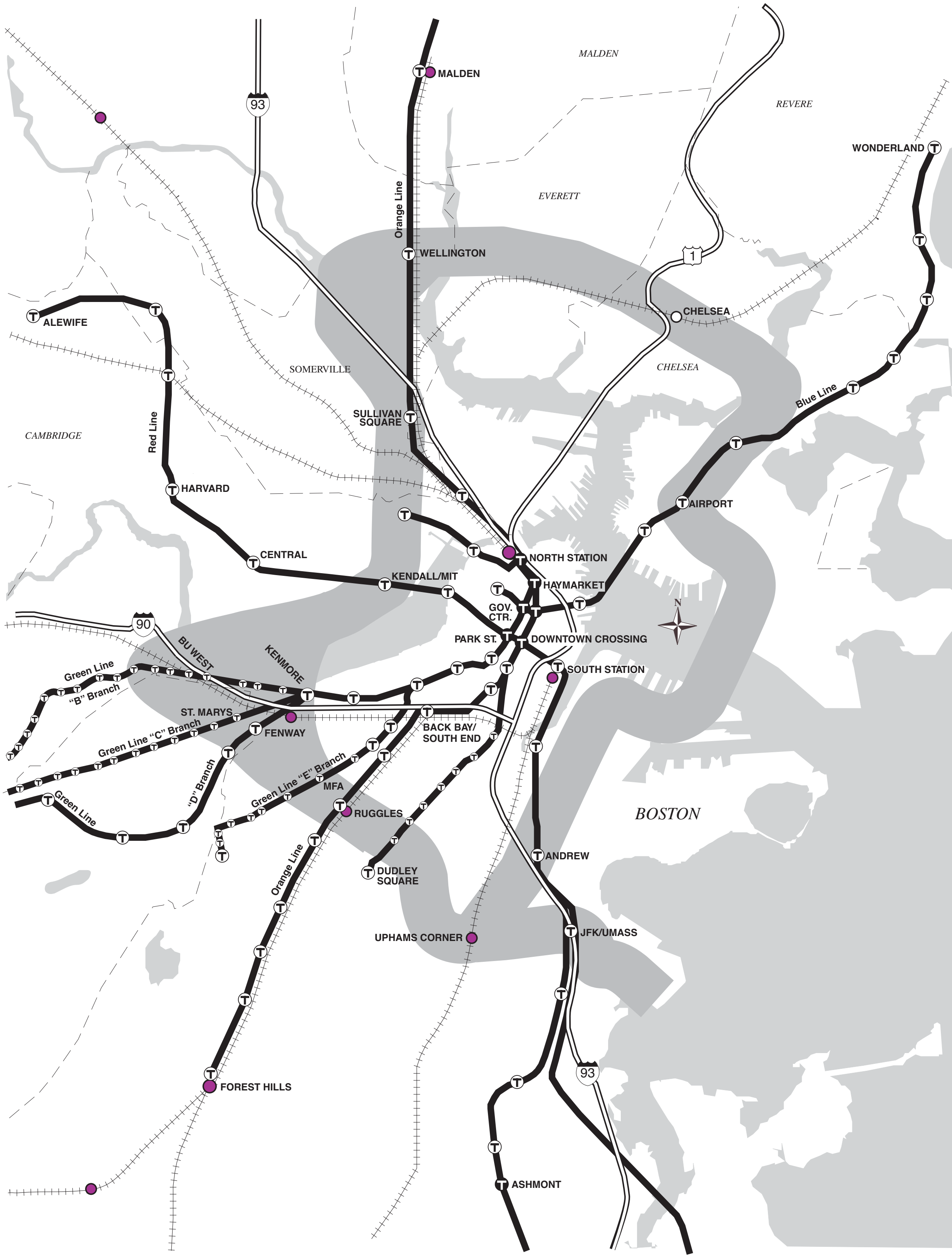
Capital Cost	**$43.7 million (CTPS estimate)**
Daily Operating Cost	**No added cost, replaces bus Routes 23 and 28**
Daily Ridership Increase on Mode	**29,300**
Net Increase in Daily Transit Ridership	**1,300**
Capital Cost/New Transit Rider	**$35,000**
Operating Cost per Wkday/New Transit Rider	**No increase, would replace existing service**
Capital Cost/Travel Time Benefit	**$172,300**
Operating Cost/Travel Time Benefit	**None**
Travel Time Savings	**250 hours per weekday**

Assessment

This is a high priority rapid transit expansion project. The capital cost for this project would be $43.7 million. This project would replace existing bus service and there would be no added operating cost compared to the service replaced. This service would attract 29,300 riders to the mode, of which only 1,300 would be new transit riders. The capital costs per new rider would be $35,000. The majority of riders would be diverted from existing bus Routes 23 and 28 which would be replaced by this service. There would be no major improvements in air quality resulting from this service, as few riders would be drawn from automobiles. Reducing the number of stops, installing signal priority systems for buses, and installing bus-only lanes would however improve travel time compared to existing local bus service. The larger articulated vehicles used on this service would reduce crowding. Reliability would be improved through the use of dedicated rights of ways, priority lanes, signal prioritization, and Automatic Vehicle Locator systems that provide real time vehicle location information to dispatchers, planners, and customers. Direct service to Downtown Boston would be available without transferring at Dudley or Ruggles as required now. Service would be provided to neighborhoods in Dorchester and Roxbury, which are target neighborhoods for environmental justice purposes. The population served would be within low-income, high-minority, and transit-dependent neighborhoods. The project would fill a gap in the rapid transit system between the existing Red Line Dorchester branch and the Orange Line.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Economic/Land Use Impacts	Environ. Justice
Line Extension	◗	◗	●	◗	●	●	●

MAP 5C-4 URBAN RING PHASE 2



URBAN RING PHASE 2

Description

The Urban Ring is a multi-phase project. Three phases have been defined and each phase will be additive; that is each new service will add capacity to previous improvements-not replace them. Phase 2 of the Urban Ring builds upon the bus routes of Phase 1 by adding seven Bus Rapid Transit (BRT) routes through the Urban Ring corridor. Some of the BRT routes in Phase 2 would be new and others would be modified or upgraded versions of Phase I bus routes. Phase 2 would utilize 60' articulated low-floor, low emission buses, segments of exclusive busway, Intelligent Transportation System (ITS) features, and supporting elements to improve connections with radial transit and commuter rail lines. Among the supporting elements would be new or expanded commuter rail stations at Downtown Chelsea, Sullivan Square, Gilman Square, Union Square, Yawkey, Ruggles, and Uphams Corner.

Capital Features

Construction of grade-separated and exclusive lane BRT segments, construction of new or expanded commuter rail stations, installation of signal priority systems for BRT vehicles, and purchase of BRT vehicles.

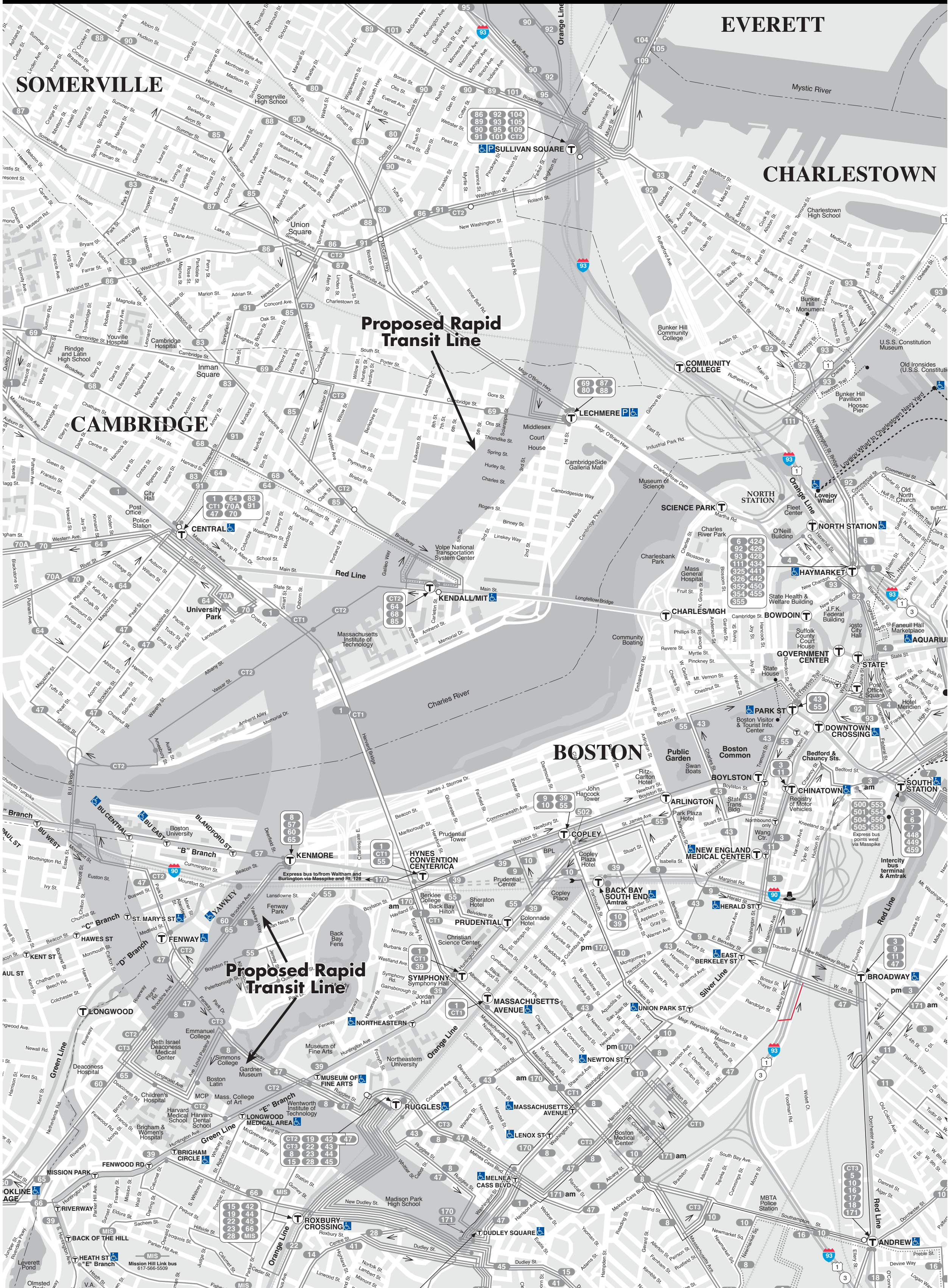
Capital Cost	**$500.0 million (Urban Ring MIS)**
Operating Cost	**$70,700 per weekday**
Daily Ridership Increase on Mode	**53,000**
Net Increase in Daily Transit Ridership	**15,000**
Capital Cost/New Transit Rider	**$33,300**
Operating Cost per Wkday/New Transit Rider	**$4.70**
Capital Cost/Travel Time Benefit	**$26,800 per hour**
Operating Cost/Travel Time Benefit	**$3.80 per hour**
Travel Time Savings	**18,692 hours per weekday**

Assessment

This is a high priority rapid transit expansion project. The capital costs for this project would be $500 million and the typical daily operating cost would be $70,700. Phase 2 of the Urban Ring would bring in 53,000 riders to the mode of which 15,000 would be new transit riders. The remaining riders would be diverted from other modes. The capital cost per new transit rider would be $33,300. The operating cost per new transit rider would be $4.70. The Urban Ring scores high for cost effectiveness both for capital and operating costs per new transit rider. Improvements to air quality as a result of this project would score highly, thanks to the large number of new transit riders diverted from automobiles. The routes would serve a number of environmental justice target neighborhoods including parts of Everett, Chelsea, Somerville, Cambridge, Roxbury, and Dorchester. Existing or proposed employment areas at Logan Airport, Chelsea, Assembly Square, Kendall Square, Cambridgeport, Longwood Medical Area, and Crosstown Center would receive direct service from this project. This results in a very high rating for land use and economic impacts. All existing radial rapid transit and commuter rail lines would interface with Urban Ring Phase 2 routes. Riders could avoid traveling through Downtown Boston by using the Urban Ring instead of transferring between existing services. Riders diverted to the Urban Ring would free up capacity on other parts of the transit network including the Red, Orange, and Green Lines. Reliability would be improved through the use of dedicated rights of ways, priority lanes, signal prioritization, and Automatic Vehicle Locator systems.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Economic/ Land Use Impacts	Environ. Justice
Line Extension	●	●	●	●	●	●	●

MAP 5C-5 URBAN RING PHASE 3



URBAN RING PHASE 3

Description

The Urban Ring is a multi-phase project. Three phases have been defined and each phase will be additive; that is each new service will add capacity to previous improvements-not replace them. Phase 3 of the Urban Ring adds a new Urban Ring rail system between the Orange Line at Assembly Square and Dudley Square operating through Sullivan, Lechmere, Kendall Square, MIT, Boston University, Longwood Medical Area, and Ruggles. Light rail or heavy rail technology would be utilized.

Capital Features

Construction of a rail rapid transit line and stations using either light rail or heavy rail modes.

Capital Cost	**$2.8 billion (Urban Ring MIS)**
Operating Cost	**$195,600 per weekday**
Daily Ridership Increase on Mode	**134,700**
Net Increase in Daily Transit Ridership	**54,600**
Capital Cost/New Transit Rider	**$51,300**
Operating Cost per Wkday/New Transit Rider	**$3.60**
Capital Cost/Travel Time Benefit	**$56,300 per hour**
Operating Cost/Travel Time Benefit	**$3.90 per hour**
Travel Time Savings	**49,695 hours per weekday**

Assessment

This is a high priority rapid transit expansion project. The capital cost for this project would be $2.8 billion and the typical daily operating cost would be $195,600. This project would complete the proposed Urban Ring network by constructing a rail system using either heavy rail technology similar to the Orange Line or light rail technology similar to the Green Line. The routing would replace a portion of the proposed Phase 2 BRT service. The total ridership increase for the mode would be 134,700 of which 54,600 would be new transit riders. The project capital cost of $2.8 billion is the most expensive rapid transit project evaluated. The capital cost per new rider would be $51,300. The operating cost per new transit rider would be $3.60. Despite the high total costs, the project scores high for both capital and operating costs per new transit rider compared to all rapid transit expansion projects. Urban Ring Phase 3 would improve mobility by reducing the number of transfers required to reach areas of anticipated employment growth in Cambridge, Allston, and Roxbury. This results in a very high rating for land use and economic impacts. Riders could avoid traveling through Downtown Boston by using the Urban Ring instead of transferring between existing services. Passengers diverted to the Urban Ring would free up capacity on other parts of the transit network including the Red, Orange, and Green Lines. There would be positive improvements in air quality, because of the large number of new transit riders this service would attract. Environmental justice needs would be met, as service would be expanded and improved to target neighborhoods in Somerville, Cambridge and Roxbury.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Economic/ Land Use Impacts	Environ. Justice
Line Extension	●	●	●	●	●	●	●


Newburyport
Haverhill
Bradford
Rowley
Lawrence
Ipswich
Andover
Rockport
Lowell
Ballardvale
Gloucester
W. Gloucester
Hamilton/Wenham
Fitchburg
N. Billerica
N. Beverly
North Wilmington
Wilmington
Beverly Depot
Montserrat
Prides Crossing
Beverly Farms
Manchester
North Leominster
Shirley
Ayer
Reading
Salem
Littleton/I-495
Mishawum
Wakefield
Greenwood
W. Concord
Swampscott
Melrose Highlands
Cedar Park
Wyoming Hill
Winchester
Wedgemere
Lynn
South Acton
Concord
Malden
Lincoln
W. Medford
Waltham
Waverly
Belmont
Porter
Chelsea
Hastings
Kendal Green
North Station
Brandeis-Roberts
South Station
Back Bay
JFK/Umass
Uphams Corner
Ruggles
Newtonville
W. Newton
Auburndale
Wellesley Farms
Wellesley Hills
Wellesley Square
Forest Hills
Needham Hts.
Morton St.
Ashland
Needham Ctr.
Worcester
Natick
W. Natick
Framingham
Hersey
Needham Jct.
Roslindale
Bellevue
Highland
W. Roxbury
Hyde Park
Fairmount
Quincy Center
Westborough
Southborough
Readville
Grafton
Dedham Corp.
Islington
Endicott
Braintree
Rte. 128
Norwood Depot
Norwood Central
Windsor Gardens
Canton Jct.
Canton Ctr.
S. Weymouth
Holbrook/Randolph
Walpole
Stoughton
Abington
Sharon
Norfolk
Montello
Whitman
Forge Park/I-495
Franklin/Dean College
Brockton
Campello
Hanson
Mansfield
Halifax
Bridgewater
Plymouth
Kingston/Route 3
Attleboro
S. Attleboro
Middleborough/Lakeville
Providence
495
95
93
3
2
190
128
1
90
290
395
24
295
195

SUBURBAN COMMUTER RAIL FEEDER BUS SERVICES

Description

This project would implement new feeder bus services to several suburban commuter rail stations that currently have no transit service connections.

Capital Features

An average of two vehicles would be needed to operate peak-period service on each new feeder route.

Capital Cost	**$7.5 million** (assuming up to 15 routes–CTPS estimate)
Operating Cost	**$29,000 per weekday** (for 15 routes with all-day service)
Daily Ridership Increase on Mode	**2,700**
Net Increase in Daily Transit Ridership	**1,900**
Capital Cost per New Transit Rider	**$3,900**
Operating Cost per Wkday/New Transit Rider	**$14.90**
Capital Cost/Travel Time Benefit	**$36,100 per hour**
Operating Cost/Travel Time Benefit	**$137.40 per hour**
Travel Time Savings	**208 hours per weekday**

Assessment

This project would provide a new alternative for access to suburban commuter rail stations. At present, use of many stations is constrained by shortages of parking capacity and a lack of access alternatives other than private automobile. Designing productive suburban routes is difficult because of low population density and scattered trip origins. Preliminary analysis indicates that the more promising new routes would include ones from the south side of Billerica to Wilmington Station, from the southeast side of Ashland to Ashland Station, from Medway via Millis to Norfolk Station, from Foxborough to Sharon Station, from Hanover via Rockland to Abington Station and from South Duxbury via Pembroke to Hanson Station. While many new suburban routes would not serve environmental justice target areas, some would serve small urban areas with low income neighborhoods. Overall, this project is rated high.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Environ. Justice
Line Extension/ New Line	◗	●	◗	◗	●	●

MAP 5C-7 URBAN RING PHASE 1

URBAN RING PHASE 1

Description

The Urban Ring is a multi-phase project. Three phases have been defined and each phase will be additive; that is each new service will add capacity to previous improvements-not replace them. Phase 1 of the Urban Ring consists of a significant expansion in the number of routes and reach of the Crosstown (CT) bus route network within Boston, Brookline, Cambridge, Chelsea, Everett, and Somerville, and the addition of new Express Commuter (EC) service to provide single seat radial and crosstown service from suburban locations into the Urban Ring corridor communities. Phase 1 bus routes will utilize 100 40-foot low-floor CNG powered buses. Maintenance facilities must be expanded to accommodate these vehicles.

Capital Features

Purchase of 100 additional CNG buses and expansion of CNG maintenance facilities.

Capital Cost	**$100.0 million (Urban Ring MIS)**
Operating Cost	**$100,300 per weekday**
Daily Ridership Increase on Mode	**21,400**
Net Increase in Daily Transit Ridership	**5,500**
Capital Cost/New Transit Rider	**$18,200**
Operating Cost per Wkday/New Transit Rider	**$ 18.20**
Capital Cost/Travel Time Benefit	**$72,000 per hour**
Operating Cost/Travel Time Benefit	**$72 per hour**
Travel Time Savings	**1388 hours per weekday**

Assessment

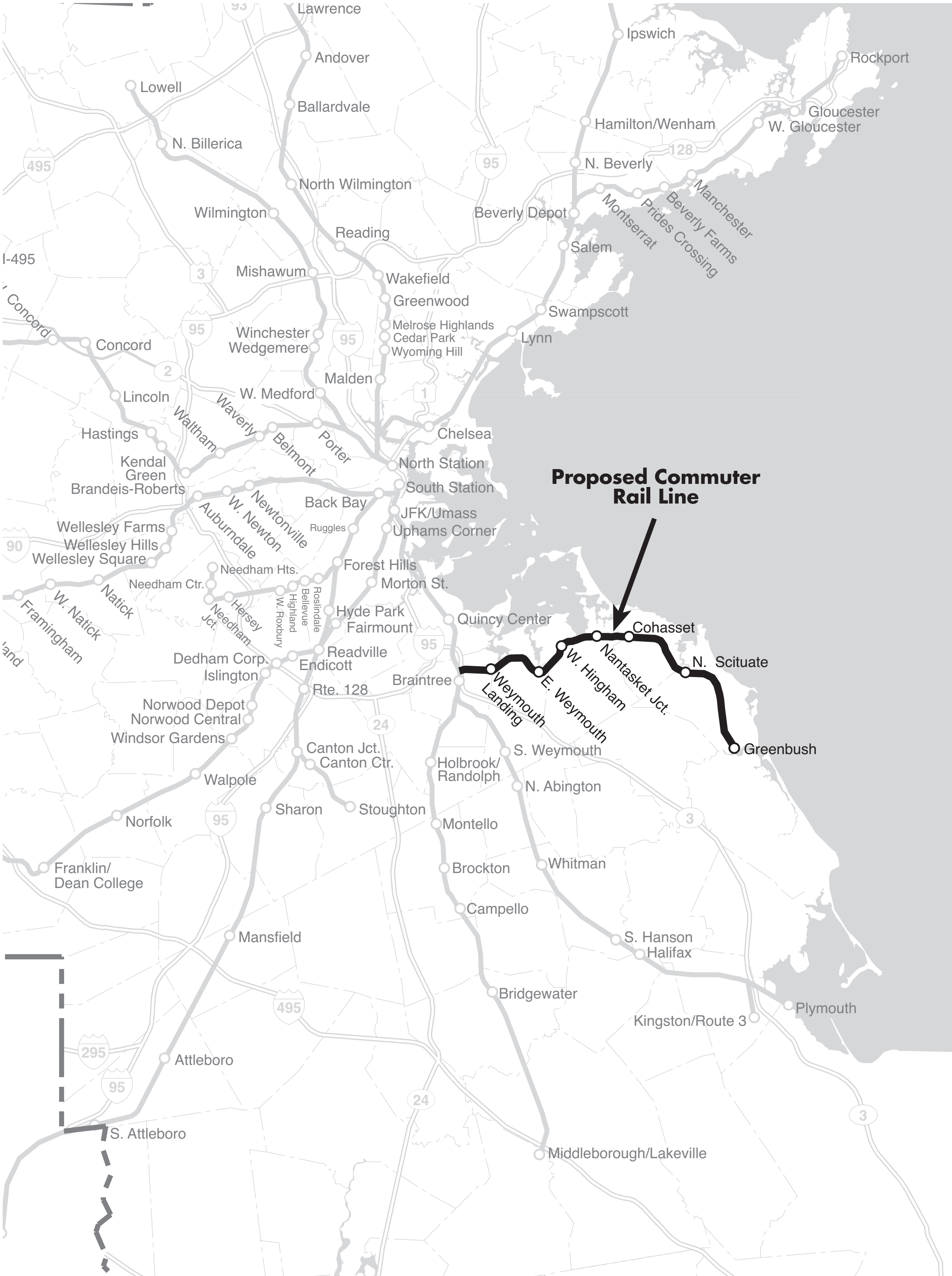
This is a high-priority bus expansion project. The capital costs for this project would be $100 million and the typical daily operating costs would be $100,300. This project would attract 21,400 riders to the mode of which 5,500 would be new transit riders. Capital cost per new transit rider would be $18,200 and operating cost per new transit rider would be $18.20. Capital costs would be limited to the acquisition of vehicles and the provision of maintenance facilities for the vehicles. The project would not be very cost effective for either capital or operating costs per new rider compared to other bus/trackless trolley expansion projects. The project would have little impact on air quality.

The service would have high utilization though and would help reduce crowding on other transit services by diverting riders. There would be a moderate impact on mobility, as the Phase I routes serve areas that have other transit alternatives, although total service offered would be increased.

Service quality would improve, as Phase I routes would reduce the amount of transfers required to complete journeys in the urban core area. The routes would serve target neighborhoods for environmental justice including parts of Chelsea, Everett, Somerville, Cambridge, Roxbury, and Dorchester. Existing or proposed employment areas at Logan Airport, Chelsea, Assembly Square, Kendall Square, University Park, Longwood Medical Area, and Crosstown Center would receive direct service from this project. All existing radial rapid transit lines would interface with Urban Ring Phase 1 routes. Riders diverted to the Urban Ring would free up capacity on other parts of the transit network including the Red, Orange, and Green Lines.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Environ. Justice
Line Extension/ New Line	●	◗	❍	❍	●	●

MAP 5C-8 COMMUTER RAIL BRANCH FROM EXISTING OLD COLONY LINES TO GREENBUSH



COMMUTER RAIL BRANCH FROM EXISTING OLD COLONY LINES TO GREENBUSH

Description

This project would restore commuter rail service on a third branch of the Old Colony lines, diverging from the route of the Middleborough/Lakeville and Plymouth/Kingston lines in Braintree and following a combination of active and inactive rail freight routes to the Greenbush section of Scituate. Rail passenger service on this branch was last operated in 1959. This project is a SIP, CA/T, and ACO legal commitment (see table 2-2).

Capital Features

Commuter rail service would be extended over 18 route-miles, of which about one mile is currently used for freight service. Extensive reconstruction on the inactive segment and upgrading of track on the active segment would be required. Several grade crossings at Hingham Center would be eliminated by placing the rail line in a tunnel. A major grade-separation project at Weymouth landing is also anticipated. There would be seven new stations on the line, in Weymouth, Hingham, Cohasset, and Scituate. The Greenbush terminal would be a short distance from the border of Marshfield.

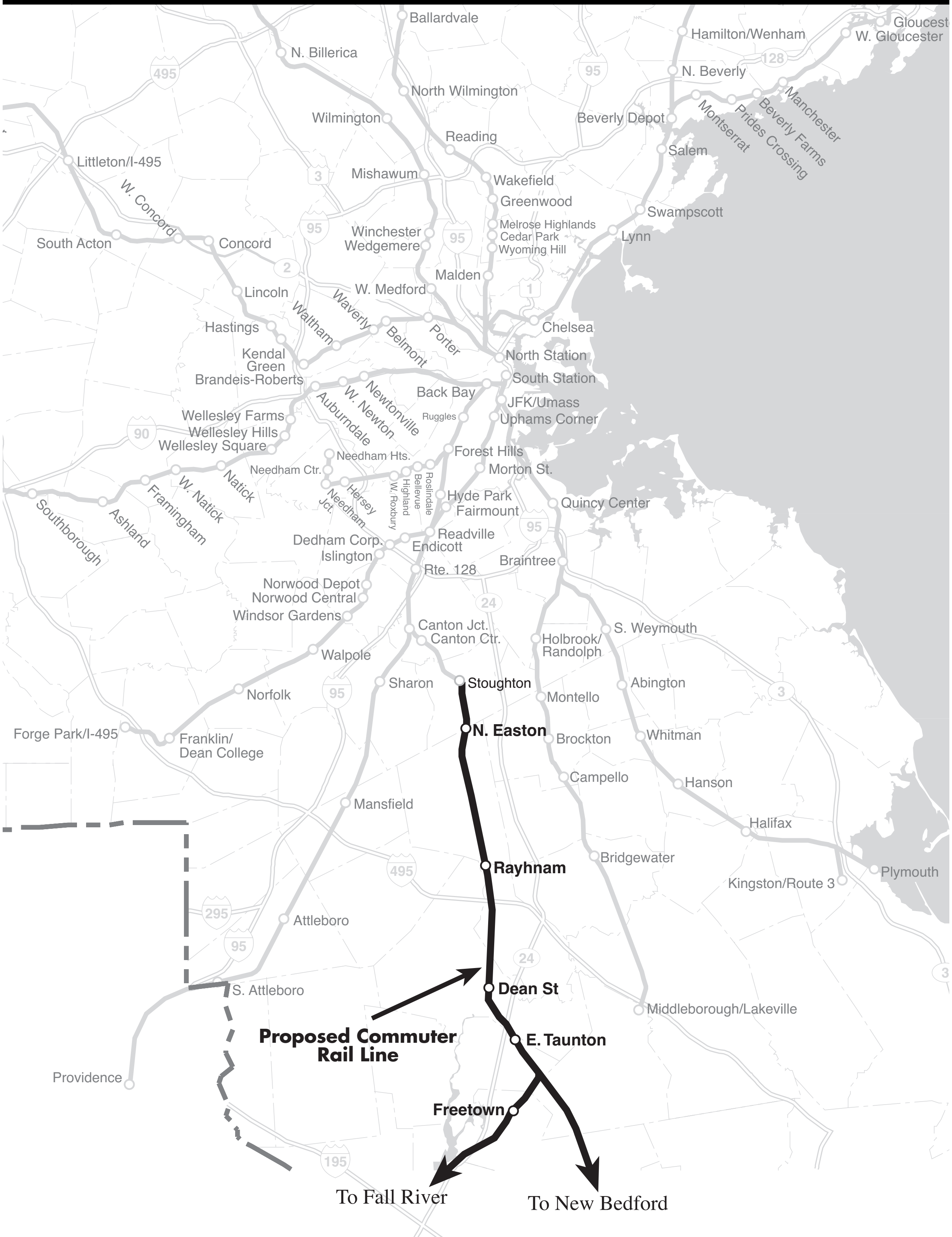
Capital Cost	**$470.0 million**
Operating Cost	**$34,000 per day**
Daily Ridership Increase on Mode	**11,400**
Net Increase in Daily Transit Ridership	**4,600**
Capital Cost per New Transit Rider	**$102,000**
Operating Cost per Wkday/New Transit Rider	**$7.40**
Capital Cost/Travel Time Benefit	**$435,500 per hour**
Operating Cost/Travel Time Benefit	**$31.40 per hour**
Travel Time Savings	**1,079 hours per weekday**

Assessment

Overall, this project is rated high priority. It would attract the second-largest number of total riders and the third-largest number of new transit riders of all commuter rail projects examined for the PMT. In absolute terms it would have one of the highest capital costs of all commuter rail projects, but because of the high ridership, the capital cost per new rider would be near the upper end of the mid-range among such projects. The operating cost per new rider would be at the lower end of the mid-range for commuter rail projects. The project would not serve any environmental justice target communities, but three of the seven stations would serve state-designated revitalization areas. It would rank fourth among all commuter rail projects in reductions of CO, CO2, and VOC emissions, but it would result in the sixth-highest increase in NOx emissions of all commuter rail projects. It would produce the fourth-highest travel time savings among such projects.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Economic/ Land Use Impacts	Environ. Justice
New Line	●	●	◗	◗	❍	❍	❍

MAP 5C-9 COMMUTER RAIL TO NEW BEDFORD/FALL RIVER



COMMUTER RAIL TO NEW BEDFORD/FALL RIVER

Description

This project would extend commuter rail service from the end of the Stoughton Line via a combination of inactive and active rail freight routes to Fall River and New Bedford. Rail passenger service to Boston from Fall River and New Bedford was last operated in 1958.

Capital Features

Commuter rail would be extended over 47 route-miles, of which 21 would be used by trains from both Fall River and New Bedford, and the rest would consist of separate branches to the two cities. Extensive reconstruction on the inactive segments and upgrading of tracks and signals on the active segments would be required. There would be seven new stations, in Easton, Raynham, Taunton, Freetown, Fall River, and New Bedford.

Capital Cost	**$670.0 million (MBTA Planning Dept. estimate)**
Operating Cost	**$69,200 per weekday**
Daily Ridership Increase on Mode	**8,700**
Net Increase in Daily Transit Ridership	**7,100**
Capital Cost per New Transit Rider	**$94,500**
Operating Cost per Wkday/New Transit Rider	**$9.80**
Capital Cost/Travel Time Benefit	**$156,800 per hour**
Operating Cost/Travel Time Benefit	**$16.20 per hour**
Travel Time Savings	**4,273 hours per weekday**

Assessment

Overall, this project is rated high-priority. It would attract the second-largest number of commuter rail riders and new transit users of all commuter rail projects examined for the PMT. New Bedford and Fall River are the seventh and eighth largest cities in Massachusetts in total population, and the largest municipalities within a 50-mile radius of Boston that now have neither commuter rail nor other rail transit service. The majority of the stations would be in state-designated revitalization areas. The project is rated medium in cost-effectiveness and in air quality benefit. In absolute terms, it would be the second-costliest commuter rail project examined, but the cost per new transit rider would be in the mid-range among such projects. It would be second only to a North-South rail link in reductions of CO, CO2, and VOC emissions, but because of the substantial number of additional locomotive-miles required, it would increase NOx emissions more than any project except a Framingham/Leominster extension.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Economic/ Land Use Impacts	Environ. Justice
Line Extension	●	●	◗	◗	❍	◗	◗

MAP 5C-10 NEW COMMUTER RAIL STATION AT UNION SQUARE, SOMERVILLE

NEW COMMUTER RAIL STATION AT UNION SQUARE, SOMERVILLE

Description

This project would add a new commuter rail station on the Fitchburg commuter rail line near Union Square in Somerville, between the existing Porter Square Station in Cambridge and North Station in Boston. A previous Union Square station was discontinued in 1938.

Capital Features

This project would consist of one new station on an existing line. No upgrading of tracks would be needed. No increase in rolling stock would be needed.

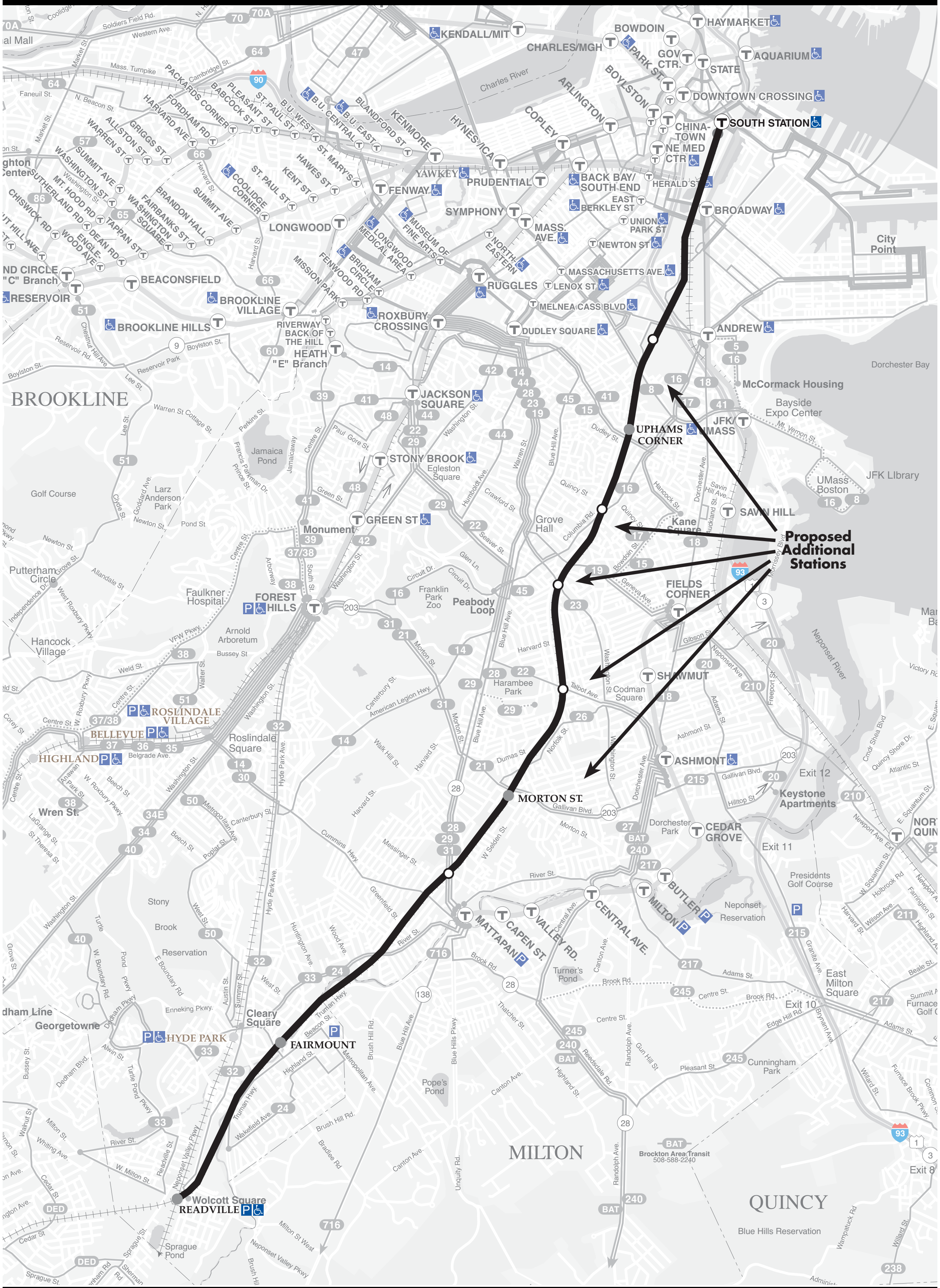
Capital Cost	**$4.1 million (CTPS estimate)**
Operating Cost	**Increased fuel from extra starts and stops, too small to calculate**
Daily Ridership Increase on Mode	**390**
Net Increase in Daily Transit Ridership	**160**
Capital Cost per New Transit Rider	**$25,400**
Operating Cost per Wkday/New Transit Rider	**Too small to calculate**
Capital Cost/Travel Time Benefit	**$58,600 per hour**
Operating Cost/Travel Time Benefit	**Too small to calculate**
Travel Time Savings	**69 hours per weekday**

Assessment

Overall, this project is rated high priority. It would provide direct commuter rail service to a densely developed section of Somerville that is now served by several local bus routes that connect with rapid transit lines. It would attract relatively few new transit riders, but because the only cost involved would be that of a new station, the capital cost per new rider would be among the lowest of all commuter rail expansion projects analyzed for the PMT. The maximum load point on Fitchburg Line trains occurs west of Porter Square, so there is sufficient excess capacity for new riders between Union Square and North Station. This project has excellent ratings in terms of environmental justice, as it would introduce direct rail service to downtown Boston from a minority neighborhood. It also rates high in economic and land use impacts because it would be in a state-designated revitalization area with plans for substantial mixed-use development. It would, however, have only a limited impact on air quality.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Economic/ Land Use Impacts	Environ. Justice
New Station	❍	◗	●	◗	❍	●	●

MAP 5C-11 FAIRMOUNT LINE IMPROVEMENTS



FAIRMOUNT LINE IMPROVEMENTS

Description

This project would upgrade service on the Fairmount commuter rail line by adding new stations on the existing route and by increasing the frequency of service.

Capital Features

Up to five new stations would be built in Boston neighborhoods, interspersed with existing stations. Approximate locations under consideration include Blue Hill Avenue near Mattapan Square, Talbot Avenue, Washington Street and Columbia Road in Dorchester, and Newmarket Square in Roxbury. Route length would not change. Some additional rolling stock would be needed to increase peak service frequency.

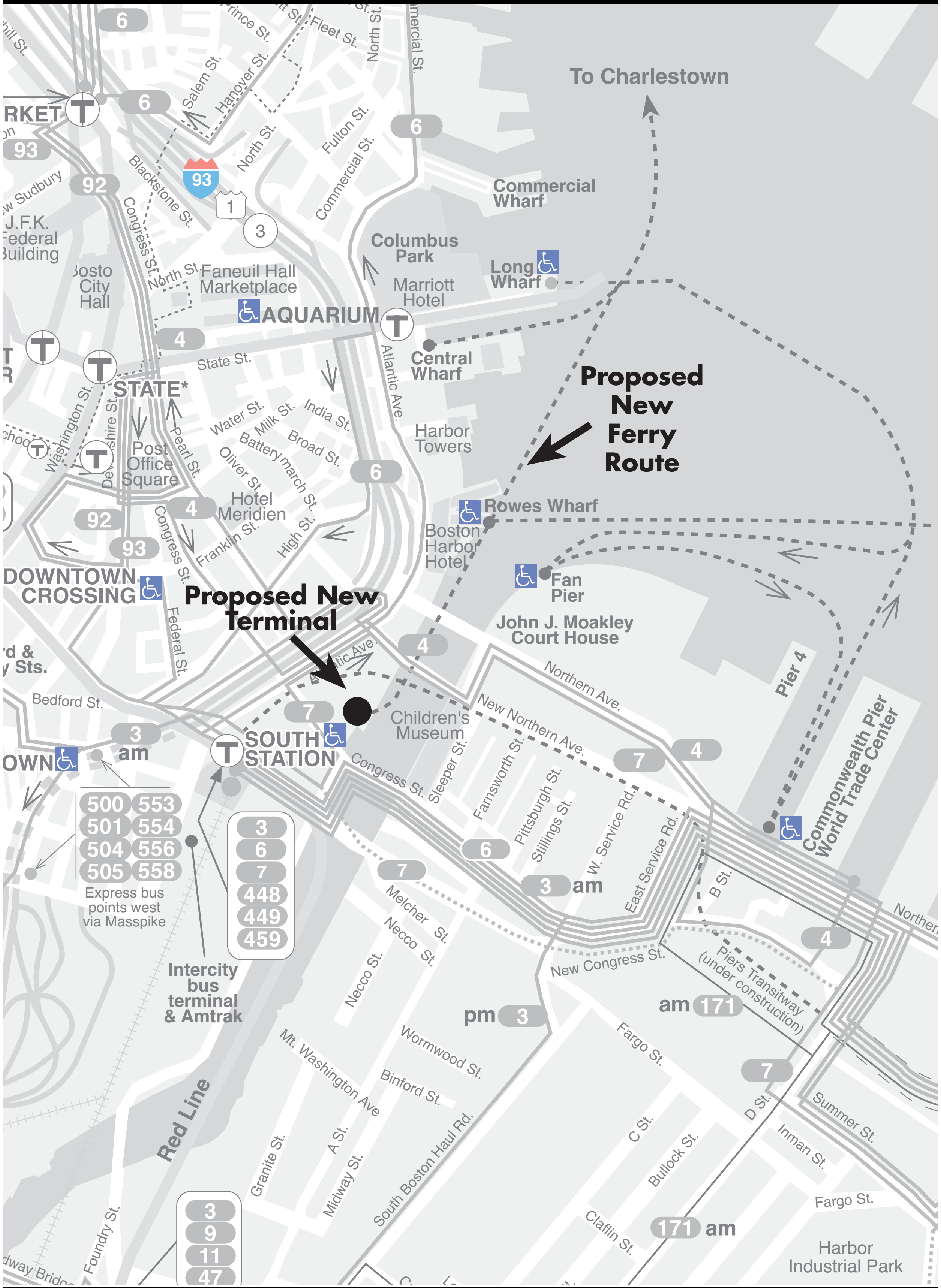
Capital Cost	**$70.0 million (MBTA Planning Dept. estimate)**
Operating Cost	**$2,800 per weekday**
Daily Ridership Increase on Mode	**6,500**
Net Increase in Daily Transit Ridership	**220**
Capital Cost per New Transit Rider	**$318,180**
Operating Cost per Wkday/New Transit Rider	**$12.70**
Capital Cost/Travel Time Benefit	**$158,000 per hour**
Operating Cost/Travel Time Benefit	**$6.30 per hour**
Travel Time Savings	**443 hours per weekday**

Assessment

Overall, this project is rated high priority. It would provide direct rail service to the Financial and Waterfront districts from sections of Dorchester now served by feeder buses to rapid transit lines. The number of riders served would be among the largest of any of the commuter rail expansion projects examined for the PMT, but the majority of them would be diverted from other transit services. Consequently, the capital cost per new transit rider would be among the highest of any commuter rail project, but the capital cost per hour of travel time saving would be among the lowest. There would be little benefit to air quality, because few auto trips would be eliminated. The project is rated high in economic and land-use impacts. All of the existing and proposed new station sites are located in state-designated revitalization areas. Local plans call for high-density residential development near these sites, along with new commercial or industrial development. Most of the stations would be in environmental justice target neighborhoods, and most of the new ones would serve areas that are not currently served directly by rail transit lines to downtown Boston. It is the only commuter rail project with a high rating for service quality, because of its contributions to passenger safety and security, comfort and convenience, and reductions of transfers.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Economic/ Land Use Impacts	Environ. Justice
New Station	◗	●	◗	❍	●	●	●

MAP 5C-12 FERRY EXPANSION–RUSSIA WHARF/SOUTH STATION



FERRY EXPANSION–RUSSIA WHARF/SOUTH STATION

Description

This project would implement a new ferry route in Boston Inner Harbor, from the existing terminal at the Charlestown Navy Yard to a new terminal at Russia Wharf, in Fort Point Channel at Congress Street. The construction of Russia Wharf is a CA/T legal commitment (see table 2-2).

Capital Features

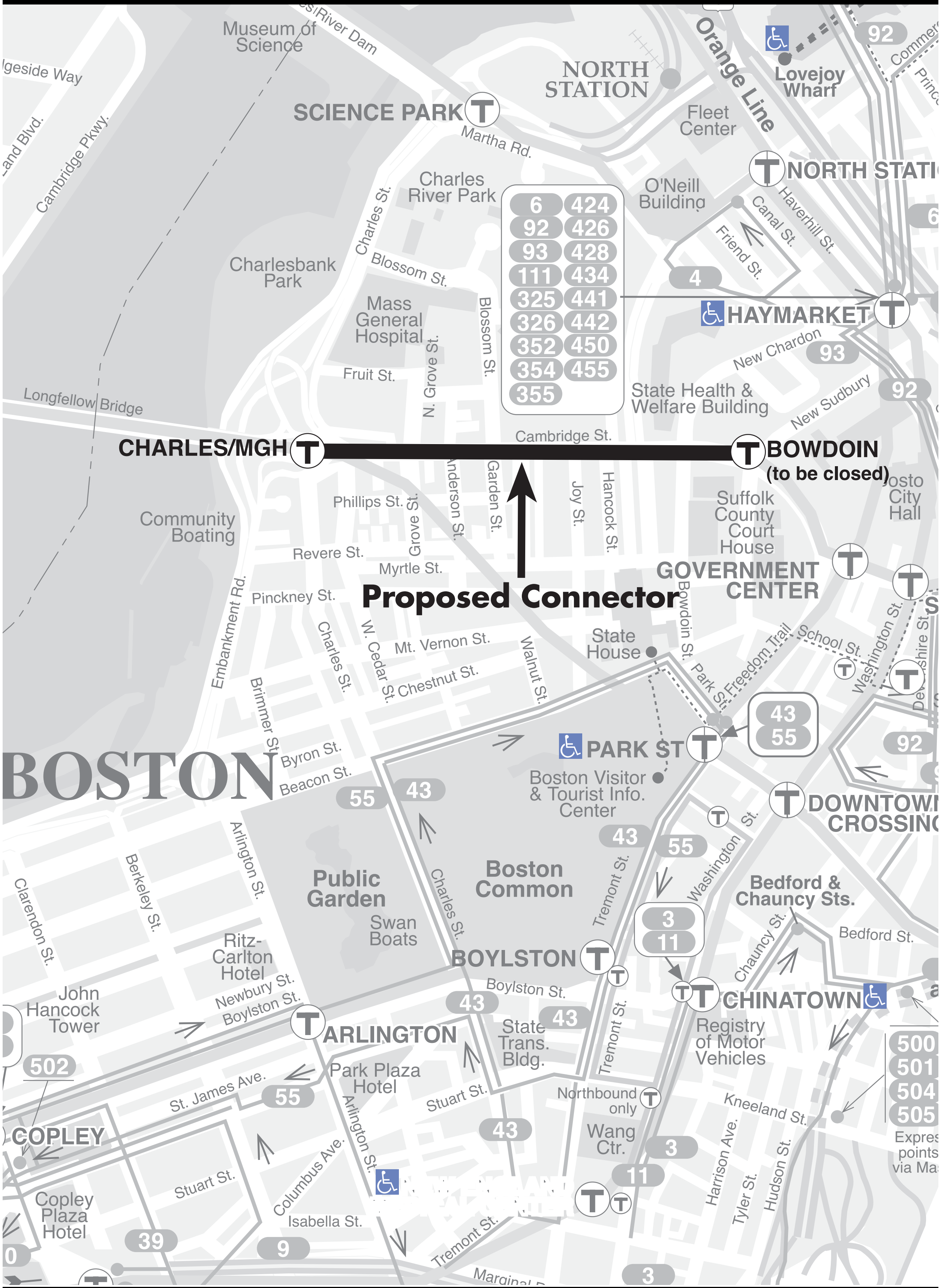
This route would require acquisition of two medium-size low-speed commuter ferries, and construction of a new terminal at Russia Wharf.

Capital Cost	**$4.0 million (CTPS estimate)**
Operating Cost	**$3,400 per day**
Daily Ridership Increase on Mode	**1,000**
Net Increase in Daily Transit Ridership	**50**
Capital Cost per New transit Rider	**$80,000**
Operating Cost per Wkday/New transit Rider	**$67.10**
Capital Cost/Travel Time Benefit	**$467,800 per hour**
Operating Cost/Travel Time Benefit	**$397.70 per hour**
Travel Time Savings	**9 hours per weekday**

Assessment

This project would provide more convenient connections from homes in the former Charlestown Navy Yard complex to work locations in much of the Financial/Retail and Waterfront districts than is currently provided by existing transit alternatives. It would attract few riders that would not otherwise use some form of transit. The capital and operating costs per new transit rider would be the second-lowest among water transportation projects examined for the PMT. The route would not provide direct service to any environmental justice target communities, but the Russia Wharf terminal would serve a state-designated revitalization area. The overall rating of this project is high priority.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Economic/ Land Use Impacts	Environ. Justice
Line Extension/ New Line	◗	◗	●	❍	◗	●	❍



CHARLES/MGH
BOWDOIN
(to be closed)
Proposed Connector
SCIENCE PARK
NORTH STATION
HAYMARKET
GOVERNMENT CENTER
PARK ST
BOYLSTON
ARLINGTON
CHINATOWN
COPLEY
BOSTON
Orange Line
Museum of Science
Charles River Park
Charlesbank Park
Mass General Hospital
Community Boating
State House
Boston Visitor & Tourist Info. Center
Boston Common
Public Garden
Swan Boats
Ritz-Carlton Hotel
John Hancock Tower
Park Plaza Hotel
State Trans. Bldg.
Wang Ctr.
Registry of Motor Vehicles
Bedford & Chauncy Sts.
Suffolk County Court House
State Health & Welfare Building
O'Neill Building
Fleet Center
Lovejoy Wharf
Copley Plaza Hotel
Longfellow Bridge
Cambridge St.
Northbound only
6 424
92 426
93 428
111 434
325 441
326 442
352 450
354 455
355
43
55
3
11
500
501
504
505

D BLUE-RED CONNECTOR

Description

This project would extend the Blue Line from Bowdoin Station in Boston to the Charles/MGH Red Line Station via a new subway, allowing a direct transfer between these lines. The Blue-Red Connector is a SIP, CA/T, and ACO legal commitment (see table 2-2).

Capital Features

This would be a 0.4-mile extension, entirely in a new subway, including the addition of a new level to the Charles/MGH Station. (Bowdoin Station is scheduled to be closed in conjunction with implementation of six-car train service on the Blue Line.)

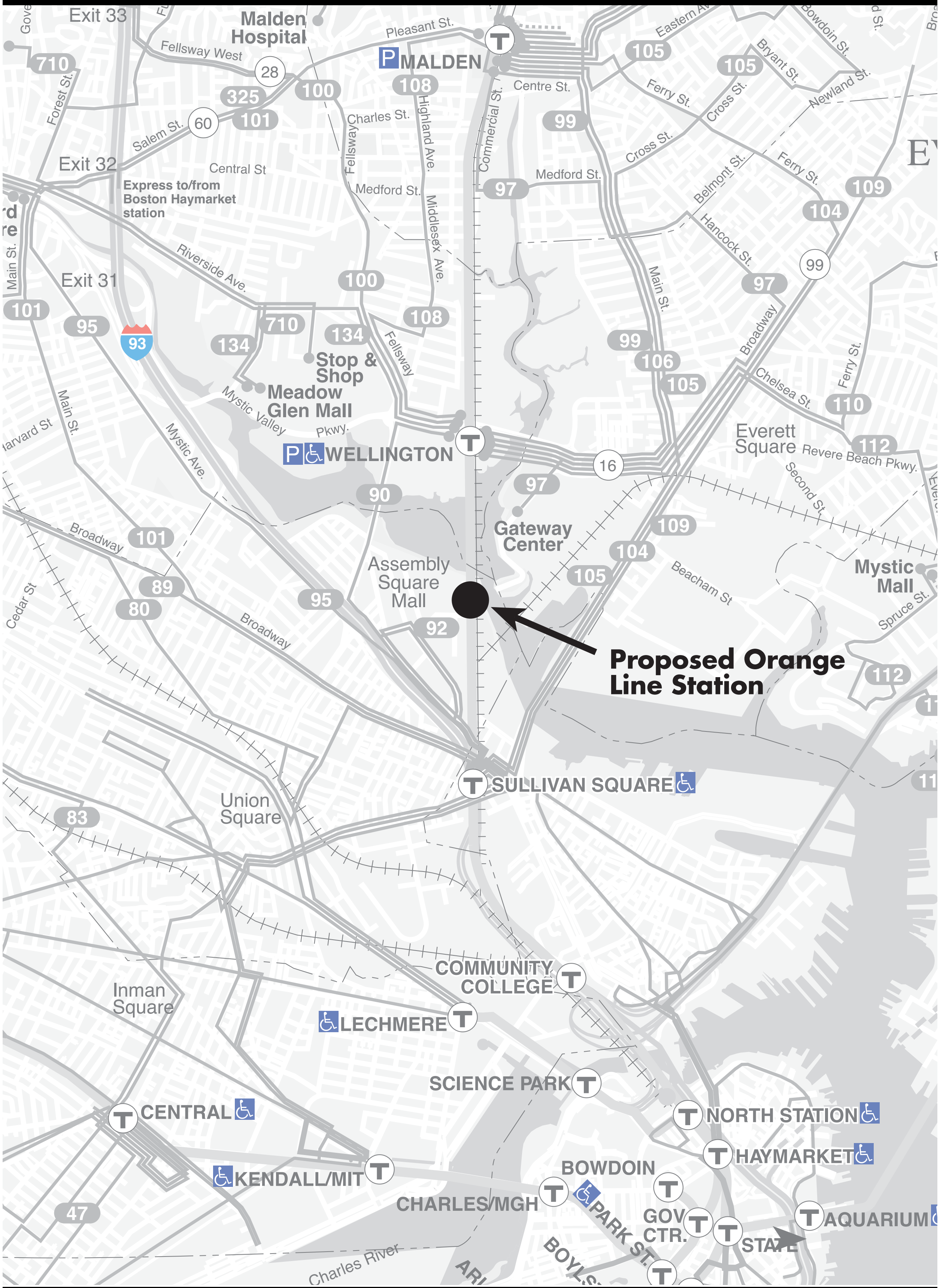
Capital Cost	**$174.6 million (Based on 2000–2025 RTP update)**
Operating Cost	**$7,200 per weekday**
Daily Ridership Increase on Mode	**6,500**
Net Increase in Daily Transit Ridership	**2,800**
Capital Cost per New Transit Rider	**$63,500**
Operating Cost per Wkday/New Transit Rider	**$2.60**
Capital Cost/Travel Time Benefit	**$107,500 per hour**
Operating Cost/Travel Time Benefit	**$4.50 per hour**
Travel Time Savings	**1,625 hours per weekday**

Assessment

Overall, this project is rated medium priority. Capital cost would be in the mid-range among rapid transit extension projects analyzed. It would be among the more cost-effective projects in terms of capital cost relative to new transit rider and to air quality improvements. Operating cost per new passenger would be among the lowest of any project. The connector would permit direct transfers between the Blue Line and the Red Line for the first time. It would be used mostly by passengers traveling between Red Line stations from Alewife to Charles/MGH inclusive and Blue Line Stations from State to Wonderland (or beyond if the Blue Line is extended in that direction). It is rated high in economic and land-use development impacts. It would be located in a state-designated revitalization area, where local plans call for mixed-use development. The MBTA will soon begin work on an analysis of the Blue-Red Connector that will provide greater detail on this project.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Economic/ Land Use Impacts	Environ. Justice
Line Extension	◗	◗	●	◗	◗	●	◗

MAP 5C-14 CONSTRUCT ORANGE LINE STATION AT ASSEMBLY SQUARE



D CONSTRUCT ORANGE LINE STATION AT ASSEMBLY SQUARE

Description

This project would add a station on the existing Orange Line at the Assembly Square development in Somerville, between Sullivan Square Station in Charlestown and Wellington Station in Medford.

Capital Features

This project would consist of one new rapid transit station, but would not add any route mileage.

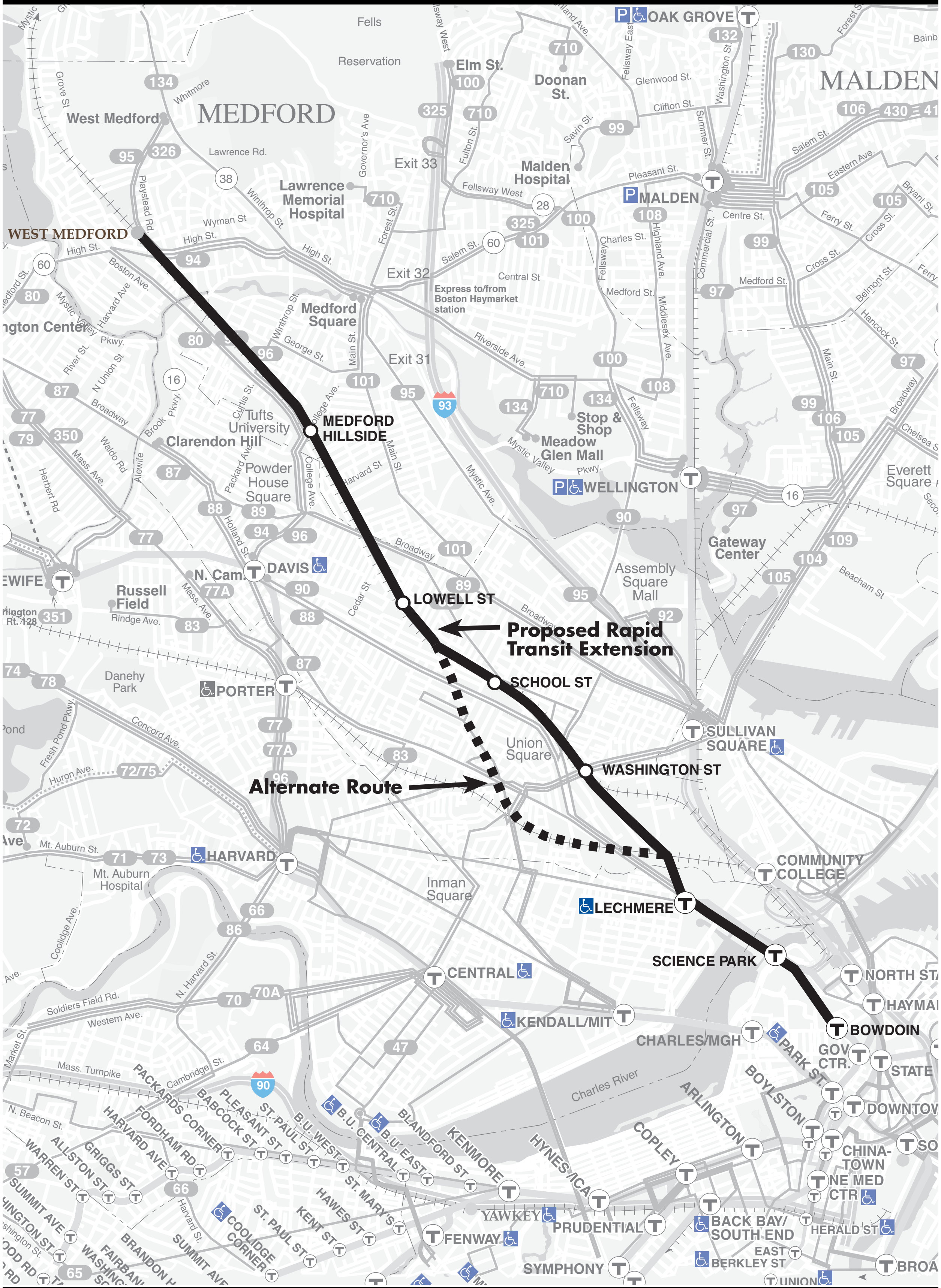
Capital Cost	**$29.3 million (MBTA Planning Dept. estimate)**
Operating Cost	**None, unless demand requires more frequent service**
Daily Ridership Increase on Mode	**1,700**
Net Increase in Daily Transit Ridership	**1,100**
Capital Cost per New Transit Rider	**$26,900**
Operating Cost per Wkday/New Transit Rider	**None, unless demand requires more frequent service**
Capital Cost/Travel Time Benefit	**$145,700 per hour**
Operating Cost/Travel Time Benefit	**None, unless demand requires more frequent service**
Travel Time Savings	**201 hours per weekday**

Assessment

Overall, this project is rated medium priority. It would add a station in a section of Somerville that the Orange Line currently runs through without stopping. This would be one of the least costly of all rapid transit expansion projects analyzed, both in absolute terms and relative to the new ridership attracted. Because of its location relative to roads, other transit stations, and most of the population of Somerville, such a station would be of use mostly for travel to and from the Assembly Square redevelopment. At this time, the mix of uses in this project has not been finally determined, making demand projections difficult. Adding an Assembly Square station would increase travel times slightly for passengers riding between stations further north and stations further south, and could worsen crowding on trains during peak hours. It gets a high rating in economic and land use impact because the station would be in a state-designated revitalization area. This includes a brownfield site. Several mixed-use transit-oriented development projects are under consideration for this location. The project receives a medium rating for environmental justice since the station is not located in a minority or transit-dependent neighborhood.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Economic/Land Use Impacts	Environ. Justice
New Station	❍	❍	●	◗	❍	●	◗

MAP 5C-15 EXTEND BLUE LINE FROM BOWDOIN TO WEST MEDFORD



D EXTEND BLUE LINE FROM BOWDOIN TO WEST MEDFORD

Description

This project would extend Blue Line service from Bowdoin Square in downtown Boston to West Medford via a new subway to Lechmere, then partly via an existing rail freight line and partly beside the Lowell commuter rail line. It would be an alternative to a Green Line extension to West Medford.

Capital Features

This would be a 5.3-mile extension, including a new subway between Bowdoin and Lechmere, six new stations in Somerville and Medford, a relocated Lechmere Station, and a new underground Science Park Station. (Bowdoin Station itself is scheduled to be closed in conjunction with implementation of six-car train service on the Blue Line.) A variation adding about one half mile would run closer to Union Square in Somerville, via a new subway under Prospect Hill. This variation is not reflected in the capital cost estimate.

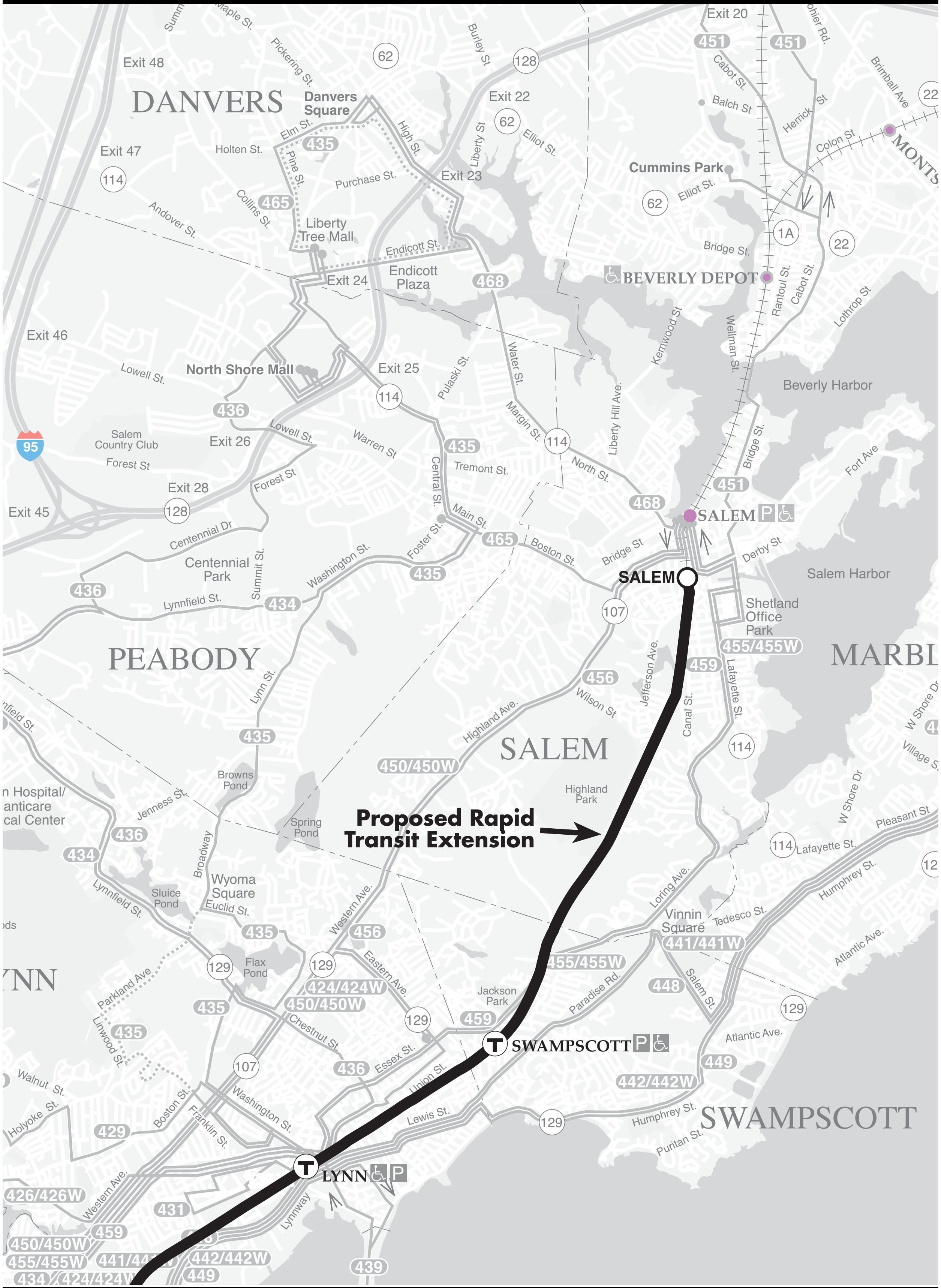
Capital Cost	**$696.5 million (Based on 1994 PMT, adjusted to 2003)**
Operating Cost	**$76,800 per weekday**
Daily Ridership Increase on Mode	**13,500**
Net Increase in Daily Transit Ridership	**5,800**
Capital Cost per New Transit Rider	**$119,500**
Operating Cost per Wkday/New Transit Rider	**$13.20**
Capital Cost/Travel Time Benefit	**$343,300 per hour**
Operating Cost/Travel Time Benefit	**$37.90 per hour**
Travel Time Savings	**2,029 hours per weekday**

Assessment

Overall, this project is rated medium priority. It would provide rail transit service to densely developed sections of Somerville and Medford that are currently served by bus routes connecting with the Green, Red, or Orange lines. It would serve more total riders and new transit riders than a Green Line extension to West Medford, but would also have a much higher capital cost per new transit rider. In absolute terms, it would be one of the most costly rapid transit projects examined. Travel times between extension stations and destinations in downtown Boston would be a few minutes faster via the Blue Line than via the Green Line. Air quality improvements would be about twice as great for a Blue Line extension as for a Green Line extension. It is rated high in economic and land use impacts. The majority of the stations would be located in state-designated revitalization areas where transit-oriented development is planned. This would include a mixture of high-density residential, commercial, and industrial development.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Economic/ Land Use Impacts	Environ. Justice
Line Extension	◗	◗	◗	◗	◗	●	●

MAP 5C-16 EXTEND BLUE LINE FROM LYNN TO SALEM



D

EXTEND BLUE LINE FROM LYNN TO SALEM

Description

This project would continue the proposed Lynn extension of the Blue Line 5 miles further north to Salem. The Blue Line would be constructed parallel to the Newburyport/Rockport commuter rail line, and the terminus would likely be placed south of the existing portal at the south end of the commuter rail tunnel under Downtown Salem. An intermediate stop would be located at Swampscott. The MBTA is currently evaluating this project as part of its Draft Environmental Impact Statement (DEIS) for the Revere to Salem corridor. It should be noted that this extension of the Blue Line is intended to complement – not replace – existing commuter rail service to the North Shore.

Capital Features

Construction of a rapid transit line extension parallel to an existing commuter rail line, purchase of additional vehicles.

Capital Cost	**$363.8 million (CTPS estimate)**
Operating Cost	**$80,500 per weekday**
Daily Ridership Increase on Mode	**15,500**
Net Increase in Daily Transit Ridership	**8,900**
Capital Cost/New Transit Rider	**$40,900**
Operating Cost per Wkday/New Transit Rider	**$9.10**
Capital Cost/Travel Time Benefit	**$666,400 per hour**
Operating Cost/Travel Time Benefit	**$147.50 per hour**
Travel Time Savings	**546 hours per weekday**

Assessment

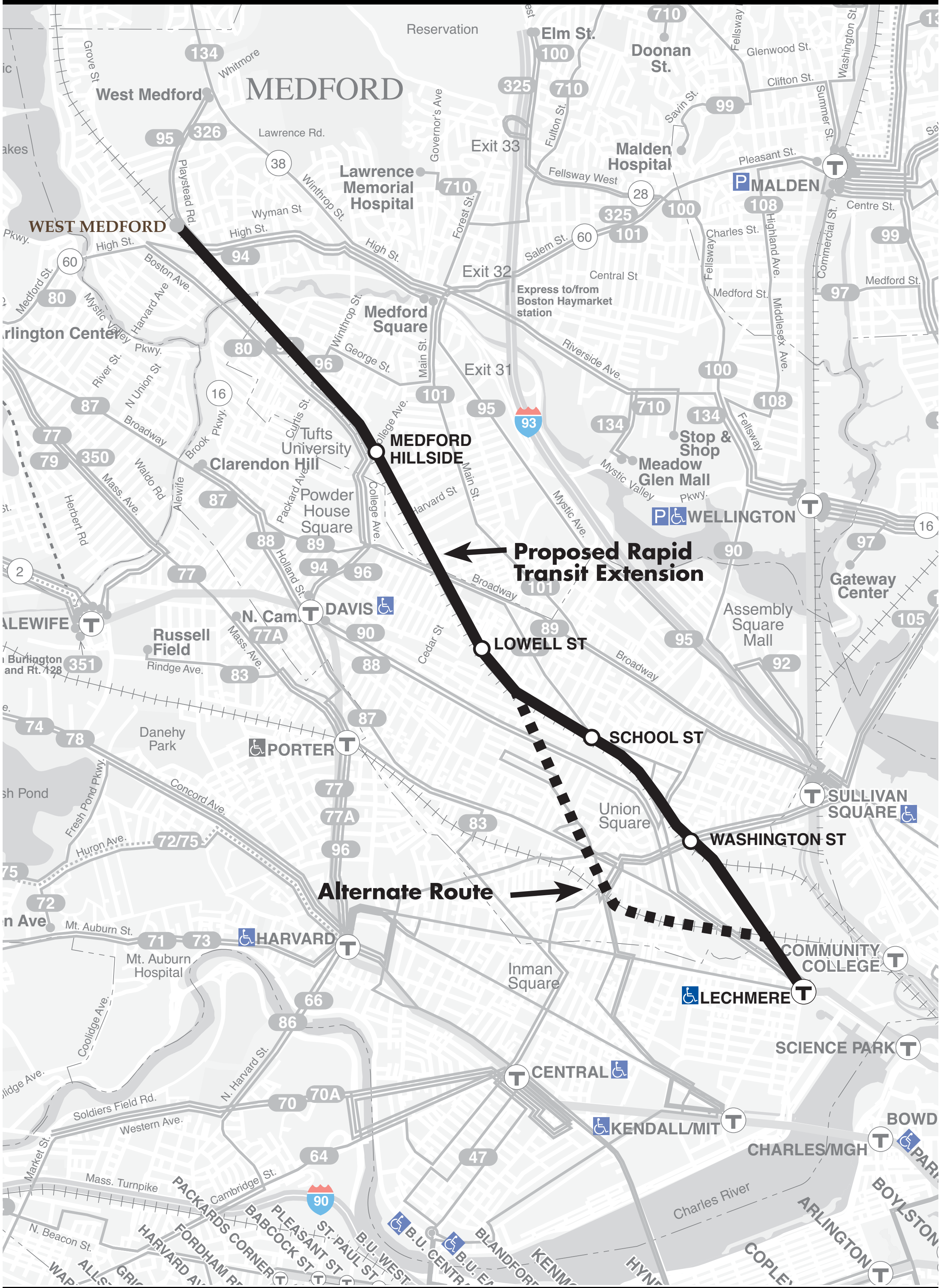
This is a medium priority rapid transit expansion project. The capital cost for this project would be $363.8 million and the typical daily operating cost would be $80,500. The extension would draw 15,900 riders to the rapid transit mode, of which 8,900 would be new transit riders. Capital costs per new transit rider would be $40,900 and operating cost per new transit rider would be $9.10. These costs are at the lower end of proposed rapid transit expansion projects, but they are surpassed by several other projects.

The improvements in air quality associated with this project are high, as there a large number of riders diverted from automobiles.

Frequency of transit service to Swampscott and Salem would increase compared to existing bus and commuter rail service. The proposed new station in Salem would also provide direct rapid transit access to an environmental justice target neighborhood not currently served by that mode.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Economic/ Land Use Impacts	Environ. Justice
Line Extension	●	◗	◗	●	❍	◗	◗

MAP 5C-17 GREEN LINE TO WEST MEDFORD



D GREEN LINE TO WEST MEDFORD

Description

This project would extend Green Line service from Lechmere Station to West Medford partly via an existing rail freight line and partly beside the Lowell commuter rail line. It would be an alternative to a Blue Line extension to West Medford. A Green Line extension to Medford Hillside is a SIP, CA/T, and ACO legal commitment (see table 2-2).

Capital Features

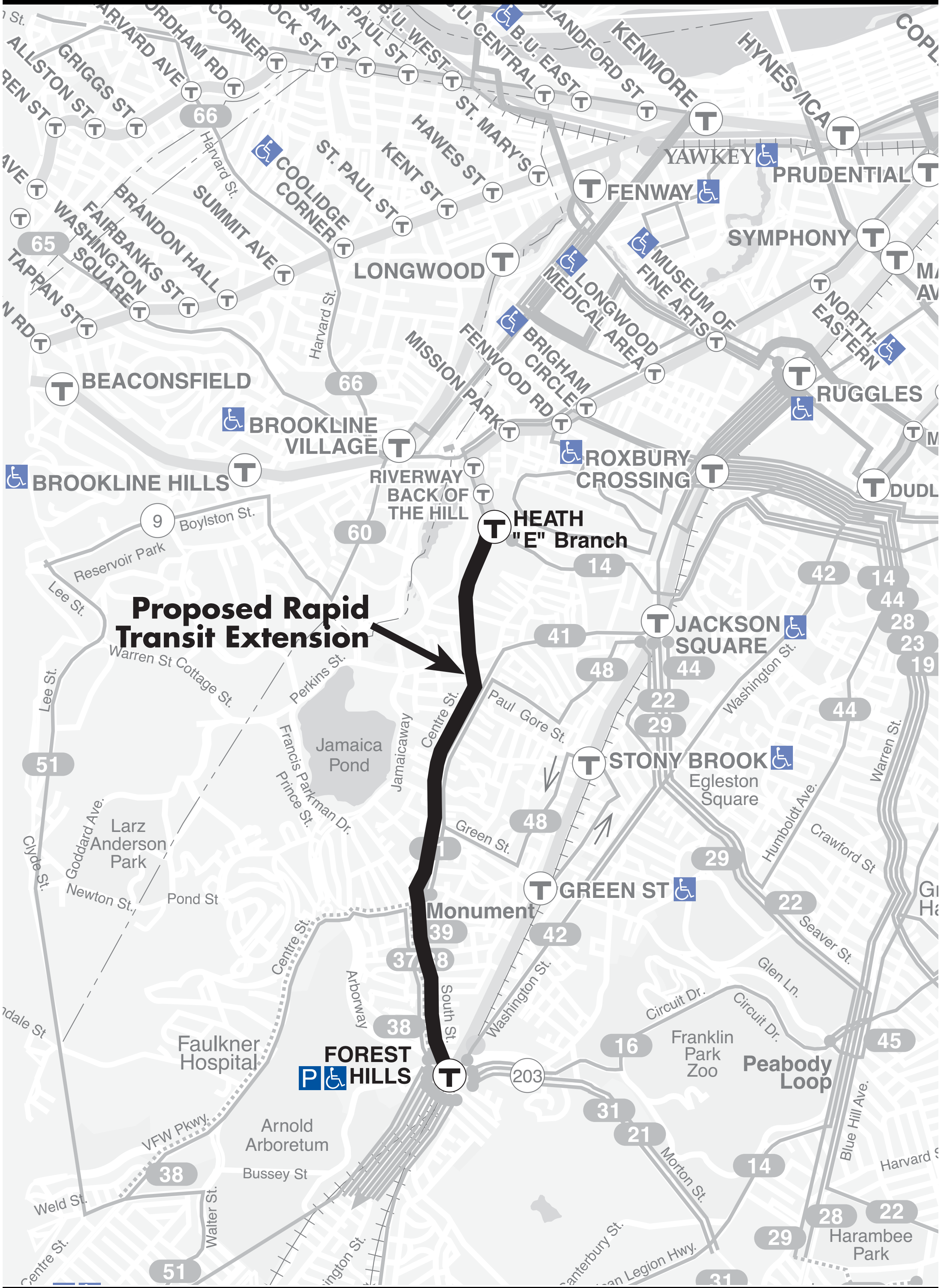
This would be a 4.2-mile extension, including six new stations, in Somerville and Medford and a relocated Lechmere Station. A variation adding about one half mile would run closer to Union Square in Somerville, via a new subway under Prospect Hill. This variation is not reflected in the capital cost estimate.

Capital Cost	**$375.0 million (Based on 2000–2025 RTP update)**
Operating Cost	**$41,700 per weekday**
Daily Ridership Increase on Mode	**8,400**
Net Increase in Daily Transit Ridership	**3,500**
Capital Cost per New Transit Rider	**$105,900**
Operating Cost per Wkday/New Transit Rider	**$11.80**
Capital Cost/Travel Time Benefit	**$227,640 per hour**
Operating Cost/Travel Time Benefit	**$25.30 per hour**
Travel Time Savings	**1,647 hours per weekday**

Assessment

Overall, this project is rated medium priority. It would provide rail transit service to densely developed sections of Somerville and Medford that are currently served by bus routes connecting with the Green, Red, or Orange lines. This would be of greater benefit in terms of convenience than of actual trip time, as it would result in fewer passengers having to transfer from bus to rail to make their trips. Air quality improvements would be only moderate, but the capital cost relative to the air quality benefits would fall in the lower range among rapid transit extensions examined. It is rated medium in economic and land use impacts. The majority of the stations would be located in state-designated revitalization areas where transit-oriented development is planned. This would include a mixture of high-density residential, commercial, and industrial development. The MBTA will soon begin work on an analysis of the extension of Green Line service to West Medford that will provide greater detail on this project.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Economic/ Land Use Impacts	Environ. Justice
Line Extension	◗	◗	◗	◗	◗	◗	●


Proposed Rapid
Transit Extension
HEATH
"E" Branch
FOREST
HILLS
RIVERWAY
BACK OF
THE HILL
BROOKLINE
VILLAGE
BROOKLINE HILLS
BEACONSFIELD
LONGWOOD
FENWAY
KENMORE
YAWKEY
PRUDENTIAL
SYMPHONY
MUSEUM OF
FINE ARTS
LONGWOOD
MEDICAL AREA
BRIGHAM
CIRCLE
FENWOOD RD
MISSION PARK
NORTHEASTERN
RUGGLES
ROXBURY
CROSSING
JACKSON
SQUARE
STONY BROOK
Egleston
Square
GREEN ST
Monument
Jamaica
Pond
Larz
Anderson
Park
Faulkner
Hospital
Arnold
Arboretum
Franklin
Park
Zoo
Peabody
Loop
Harambee
Park
Centre St.
South St.
Washington St.
Arborway
Jamaicaway
Perkins St.
Paul Gore St.
Green St.
Boylston St.
Reservoir Park
Warren St
Cottage St.
Lee St.
Goddard Ave.
Newton St.
Pond St
VFW Pkwy.
Bussey St
Walter St.
Weld St.
Morton St.
Circuit Dr.
Glen Ln.
Seaver St.
Humboldt Ave.
Crawford St
Warren St.
Blue Hill Ave.
Francis Parkman Dr.
Prince St.
Harvard St.
Summit Ave
Coolidge Corner
St. Paul St
Kent St
Hawes St
St. Mary's St
B.U. East
B.U. Central
B.U. West
Blandford St
Hynes/ICA
Brandon Hall
Fairbanks St
Washington Square
Tappan St
Allston St
Griggs St
Harvard Ave
Fordham Rd
Canterbury St.
66
65
60
9
14
41
48
42
44
22
29
28
23
19
51
39
37
38
16
45
203
31
21

D RESTORE GREEN LINE SERVICE BETWEEN HEATH ST AND ARBORWAY

Description

This project would restore service on the Green Line E-branch between Heath Street and Arborway, a distance of 1.9 miles. Rail service in this segment was last operated in 1985 with PCC streetcars. The infrastructure would need to be replaced and upgraded to allow for operation of modern light-rail equipment.

Restoration would include replacement of track, replacement of catenary and power systems, installation of accessible station platforms at intermediate stops, and construction of a storage yard at Arborway. This project is a SIP and ACO legal commitment (see table 2-2).

Capital Features

Reconstruction of 1.9 miles of street-running light rail trackage, construction of intermediate stations, and purchase of additional vehicles.

Capital Cost	**$71.9 million (Based on 2001 MBTA Planning Study)**
Operating Cost	**No added cost, would replace Route 39**
Daily Ridership Increase on Mode	**14,200**
Net Increase in Daily Transit Ridership	**200**
Capital Cost/New Transit Rider	**$359,400**
Operating Cost per Wkday/New Transit Rider	**No added cost**
Capital Cost/Travel Time Benefit	**$11,115,800**
Operating Cost/Travel Time Benefit	**No added cost**
Travel Time Savings	**6 hours per weekday**

Assessment

This is a medium priority rapid transit expansion project. The capital cost for this project is $71.9 million. Because this project would replace Route 39 bus service, there would be no anticipated increase in total system operating costs. Green Line service between Heath Street and Arborway was replaced with Route 39 bus service in December 1985. Restoration of Arborway service is a project required as part of Central Artery mitigation agreements. The existing E-Heath Street Green Line branch would be extended back to Arborway (Forest Hills) and Route 39 bus service discontinued. Green Line ridership would expand by 14,200 compared to the existing Heath Street service. Of this total, 200 passengers per day would be new transit riders, the majority would be former patrons of Route 39 bus service. The capital cost per new transit rider would be very high at $359,400. There would be no increase in operating costs per new passenger however, as this project would replace bus Route 39.

Impacts on air quality would be low, as few new riders would be diverted from automobiles to this service. Part of the line would serve environmental justice communities. Restoration of service would provide one-seat rides between Jamaica Plain and Park Street, with improved transfers to the remainder of the rapid transit system. Frequency of service available in the entire corridor between Forest Hills and Copley, however, would be reduced, as the present overlap of service in the Heath Street-Copley segment between bus Route 39 and E-Heath Street Green Line service would be eliminated.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Economic/Land Use Impacts	Environ. Justice
Line Extension	❍	❍	◗	❍	●	●	◗

D SILVER LINE EAST EXTENSION TO CITY POINT

Description

This project would extend Silver Line bus rapid transit service 2.9 miles beyond World Trade Center station into the South Boston neighborhood of City Point. Bus Rapid Transit vehicles would leave the transitway tunnel at World Trade Center and continue on the surface via Summer Street, L Street and East Broadway. Bus priority lanes and sheltered stops containing passenger information would be constructed along the route. ITS technology would be used to monitor and regulate service.

Capital Features

Construction and installation of dedicated bus lanes, priority signals, and passenger shelters with amenities. Purchase of additional dual-mode vehicles.

Capital Cost	**$11.4 million (CTPS estimate)**
Operating Cost	**$3,800 per weekday**
Daily Ridership Increase on Mode	**6,800**
Net Increase in Daily Transit Ridership	**1,400**
Capital Cost/New Transit Rider	**$8,400**
Operating Cost per Wkday/New Transit Rider	**$2.80**
Capital Cost/Travel Time Benefit	**$71,900**
Operating Cost/Travel Time Benefit	**$23.60**
Travel Time Savings	**159 hours per weekday**

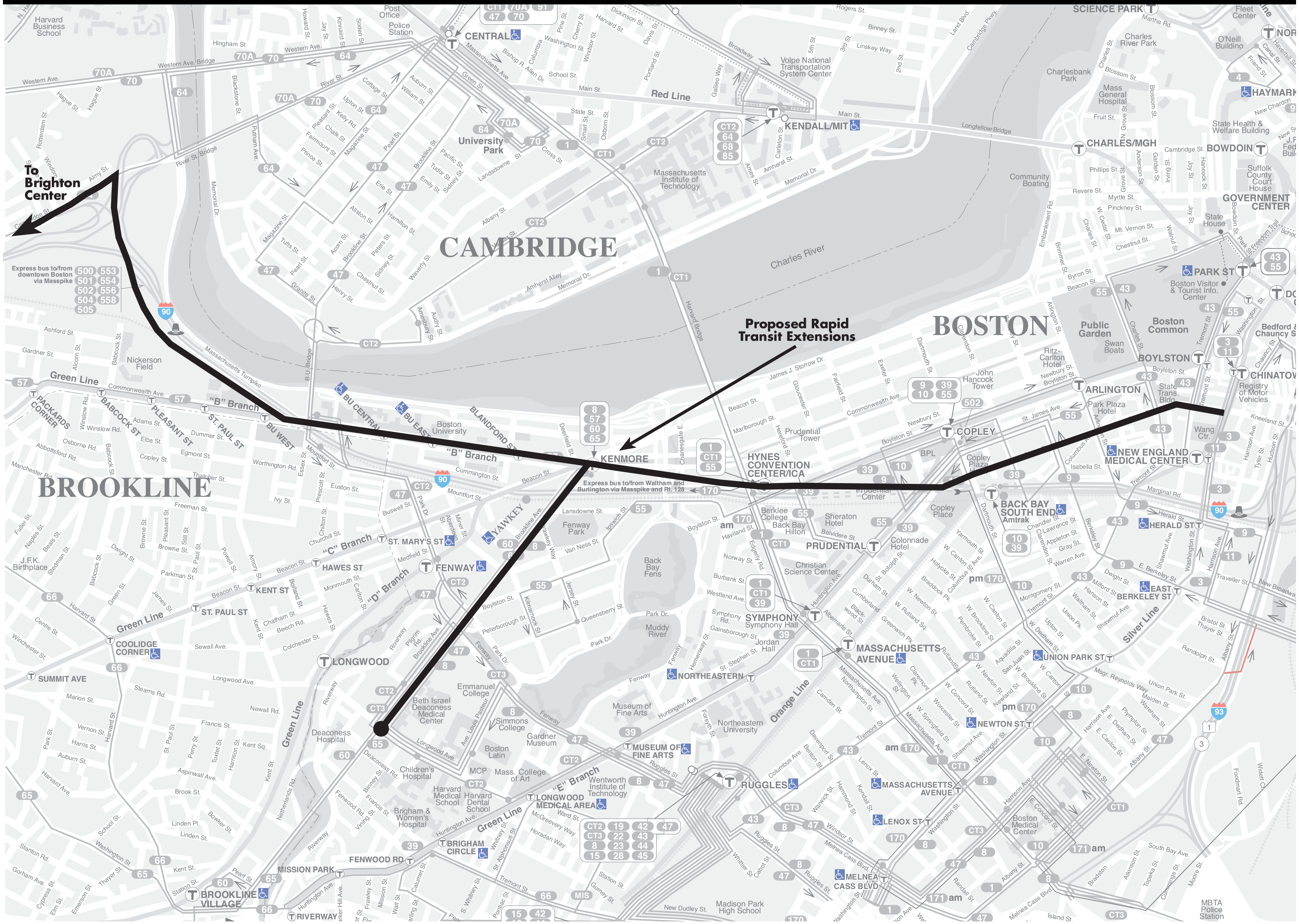
Assessment

This is a medium priority rapid transit expansion project. The capital cost for this project would be $11.4 million and the typical additional daily operating cost would be $3,800. This project would provide Silver Line service farther into South Boston beyond the Phase-2 service to Courthouse and World Trade Center stations now already under construction. Capital investment would be minimal, as buses would make use of improvements to the existing street network between World Trade Center and City Point. The service would attract 6,800 riders, of which approximately 20% (1,400) would be new transit riders. The remaining passengers would be diverted from existing bus routes, especially Route 7 City Point-Downtown, which would be replaced by this service. The capital cost per new transit rider would be low at $8,400 and the operating cost per new transit rider beyond that required by existing Route 7 service would also be low at $2.80. This would be a very cost-effective project.

Reliability would be improved through the use of dedicated rights of ways, priority lanes, signal prioritization, and Automatic Vehicle Locator systems that provide real time vehicle location information to dispatchers, planners, and customers.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Economic/ Land Use Impacts	Environ. Justice
Line Extension	◗	❍	●	◗	◗	●	❍

MAP 5C-20 SILVER LINE WEST EXTENSIONS TO ALLSTON AND LONGWOOD MEDICAL AREA



D SILVER LINE WEST EXTENSIONS TO ALLSTON & LONGWOOD MEDICAL AREA

Description

This project calls for the construction of a new bus rapid transit tunnel which would split from the Phase III Silver Line tunnel near Boylston station and continue under Stuart Street and a new alignment to Kenmore Square. From Kenmore, service would continue along the surface on two branches. One would operate to the Longwood Medical Area, and the other would operate to Oak Square, Brighton via the Allston Landing development, Union Square, Allston, and Brighton Center.

It should be noted that through its *Access Boston* process, the city of Boston has identified an alternative description for a western extension of the Silver Line that could be achieved at a lower capital cost. This option would involve bus rapid transit along surface streets and the Massachusetts Turnpike through the Back Bay instead of through an underground subway line. However, only the first option is assessed in the PMT.

Capital Features

Construction of a bus rapid transit tunnel, roadway improvements west of Kenmore Square, and purchase of additional dual-mode vehicles.

Capital Cost	**$540.9 million (CTPS estimate)**
Operating Cost	**$25,600 per weekday**
Daily Ridership Increase on Mode	**27,900**
Net Increase in Daily Transit Ridership	**7,800**
Capital Cost/New Transit Rider	**$69,000**
Operating Cost per Wkday/New Transit Rider	**$3.30**
Capital Cost/Travel Time Benefit	**$619,640 per hour**
Operating Cost/Travel Time Benefit	**$29.35 per hour**
Travel Time Savings	**873 hours per weekday**

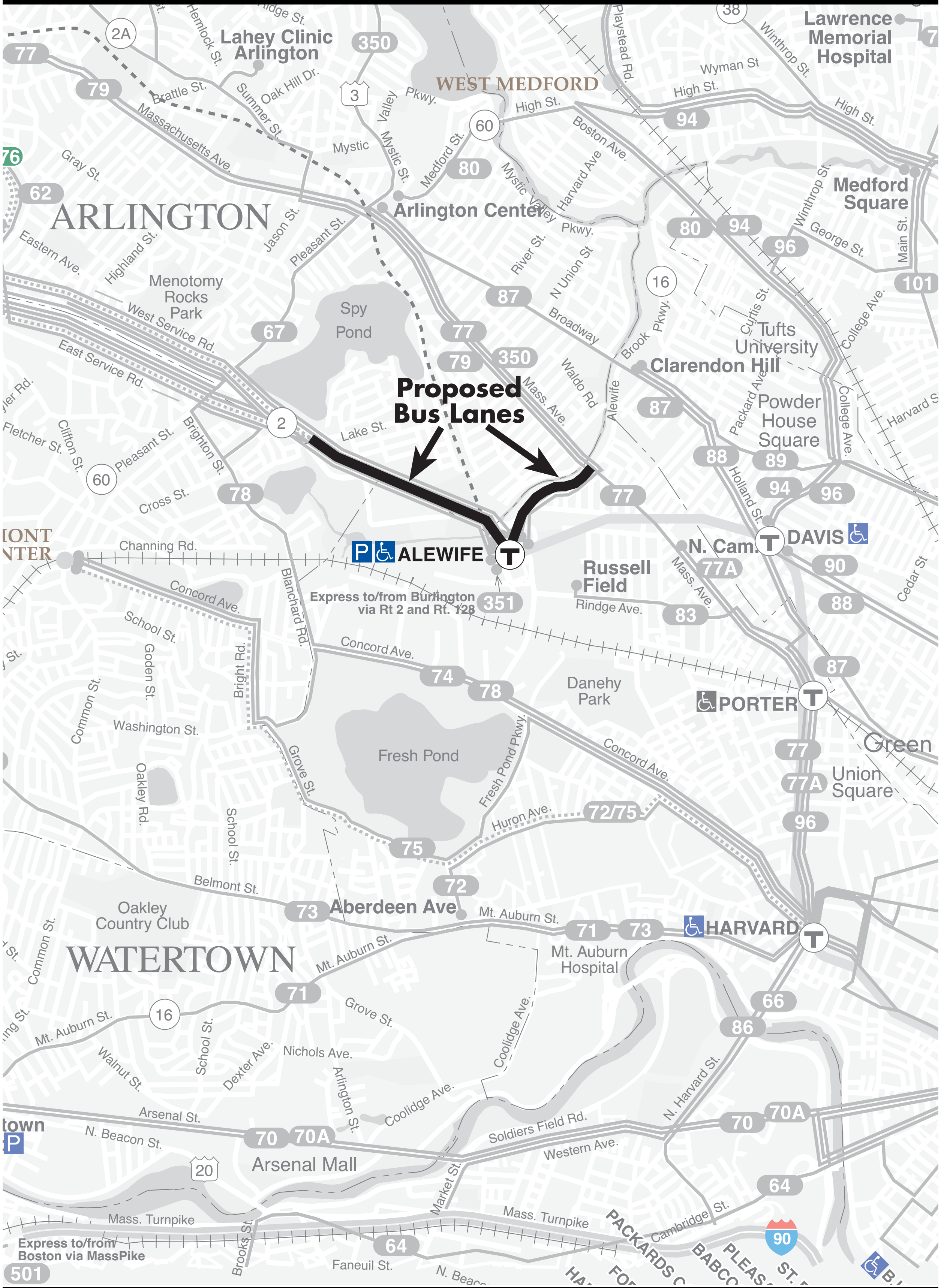
Assessment

This is a medium priority rapid transit expansion project. The capital cost for this project would be $540.9 million and the typical daily operating cost would be $25,600. This project would attract 27,900 passengers to the mode of which 7,800 would be new transit riders. The capital cost for the project would be $69,000 per new transit rider, and the operating cost per new transit rider would be $3.30. The project would have a positive impact on air quality, as many users would be diverted from automobiles. The project would also provide crowding relief to the parallel Green Line through the Back Bay. The Allston branch would provide direct service to the Allston Landing development area and densely developed mixed-use developments in Allston and Brighton. The Allston branch would fill a gap in the rapid transit system between the Red Line in Cambridge and the Green Line B-branch. The Longwood Avenue branch would increase service to the Longwood Medical Area. Direct service to Downtown Boston would be provided from Allston/Brighton and Longwood Medical Area, eliminating transfers.

Reliability would be improved through the use of dedicated rights of ways, priority lanes, signal prioritization, and Automatic Vehicle Locator systems that provide real time vehicle location information to dispatchers, planners, and customers.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Economic/ Land Use Impacts	Environ. Justice
Line Extension	●	◗	◗	◗	◗	●	◗

MAP 5C-21 BUILD NEW BUSWAYS TO ALEWIFE STATION



D BUILD NEW BUSWAYS TO ALEWIFE STATION

Description

This proposal calls for the installation of exclusive bus lanes between Alewife Station and Massachusetts Avenue along Alewife Brook Parkway and between Alewife Station and Lake St. along Route 2. These lanes would improve travel times for bus Routes 62 (Bedford-Alewife), 67 (Turkey Hill-Alewife), 76 (Hanscom Air Force Base-Alewife), 79 (Arlington Heights-Alewife), 84 (Arlmont-Alewife), and 350 (Burlington-Alewife).

Capital Features

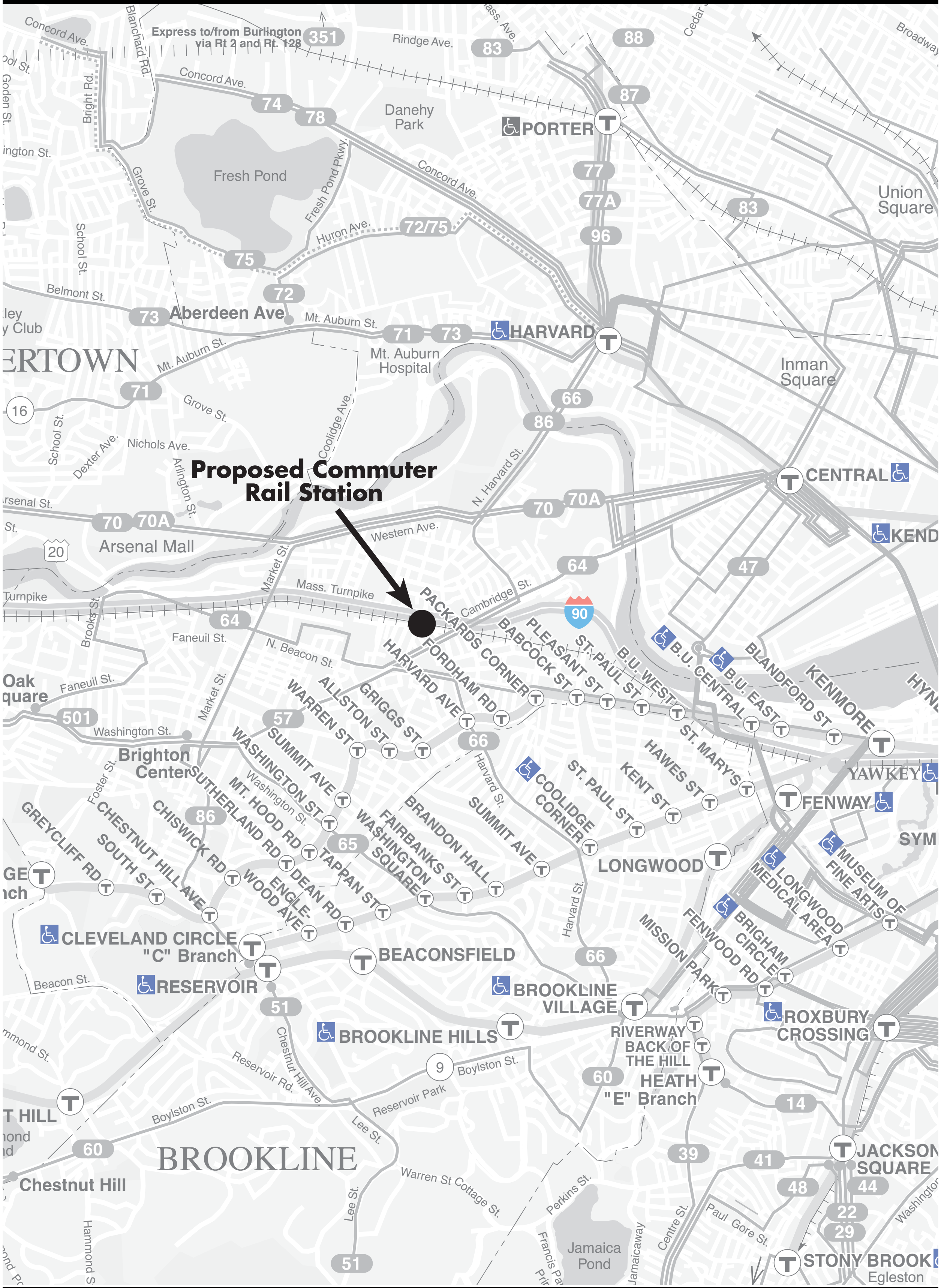
Construction of exclusive bus lanes.

Capital Cost	**$340,000 (CTPS estimate)**
Operating Cost	**none**
Daily Ridership Increase on Mode	**600**
Net Increase in Daily Transit Ridership	**340**
Capital Cost/New Transit Rider	**$1000**
Operating Cost per Wkday/New Transit Rider	**no change**
Capital Cost/Travel Time Benefit	**$5,9100per hour**
Operating Cost/Travel Time Benefit	**NA**
Travel Time Savings	**58 hours per weekday**

Assessment

This is a medium-priority bus expansion project. The capital cost for this project would be $340,000. There is no anticipated additional operating cost. This project would attract 600 new users to the mode of which 340 would be new transit riders. The capital cost per new transit rider would be $1000. The total cost effectiveness for the project scores high compared to other bus expansion projects. Providing exclusive lanes for buses on the roadways approaching Alewife Station would improve the travel times of the existing bus service and would improve the reliability, as buses would be less vulnerable to delays caused by heavy traffic congestion in the Alewife area. There would be no improvement in mobility, as all bus routes using the busways would be existing ones.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Environ. Justice
Line Extension/ New Line	❍	❍	●	◗	◗	❍


Proposed Commuter Rail Station
PORTER
HARVARD
CENTRAL
Fresh Pond
Danehy Park
Union Square
Inman Square
Mt. Auburn Hospital
Arsenal Mall
Aberdeen Ave
Mass. Turnpike
Western Ave.
Cambridge St.
N. Beacon St.
Brighton Center
Oak Square
PACKARDS CORNER
BABCOCK ST
PLEASANT ST
ST. PAUL ST
B.U. WEST
B.U. CENTRAL
B.U. EAST
BLANDFORD ST
KENMORE
FENWAY
YAWKEY
LONGWOOD
LONGWOOD MEDICAL AREA
MUSEUM OF FINE ARTS
BRIGHAM CIRCLE
FENWOOD RD
MISSION PARK
COOLIDGE CORNER
BROOKLINE VILLAGE
BROOKLINE HILLS
BEACONSFIELD
RESERVOIR
CLEVELAND CIRCLE
"C" Branch
RIVERWAY
BACK OF THE HILL
HEATH
"E" Branch
ROXBURY CROSSING
JACKSON SQUARE
STONY BROOK
BROOKLINE
Chestnut Hill
Jamaica Pond
Express to/from Burlington via Rt 2 and Rt. 128

D BUILD A NEW ALLSTON/BRIGHTON COMMUTER RAIL STATION

Description

This project would add a new commuter rail station on the Framingham/ Worcester commuter rail line in either Allston or Brighton. It would be between the existing Newtonville and Yawkey stations. Four previous commuter rail stations in Allston and Brighton were all discontinued in 1959 as part of a larger service reduction.

Capital Features

This project would consist of one new station with limited parking on an existing line. No upgrading of tracks would be needed. No new rolling stock would be required to accommodate the additional riders.

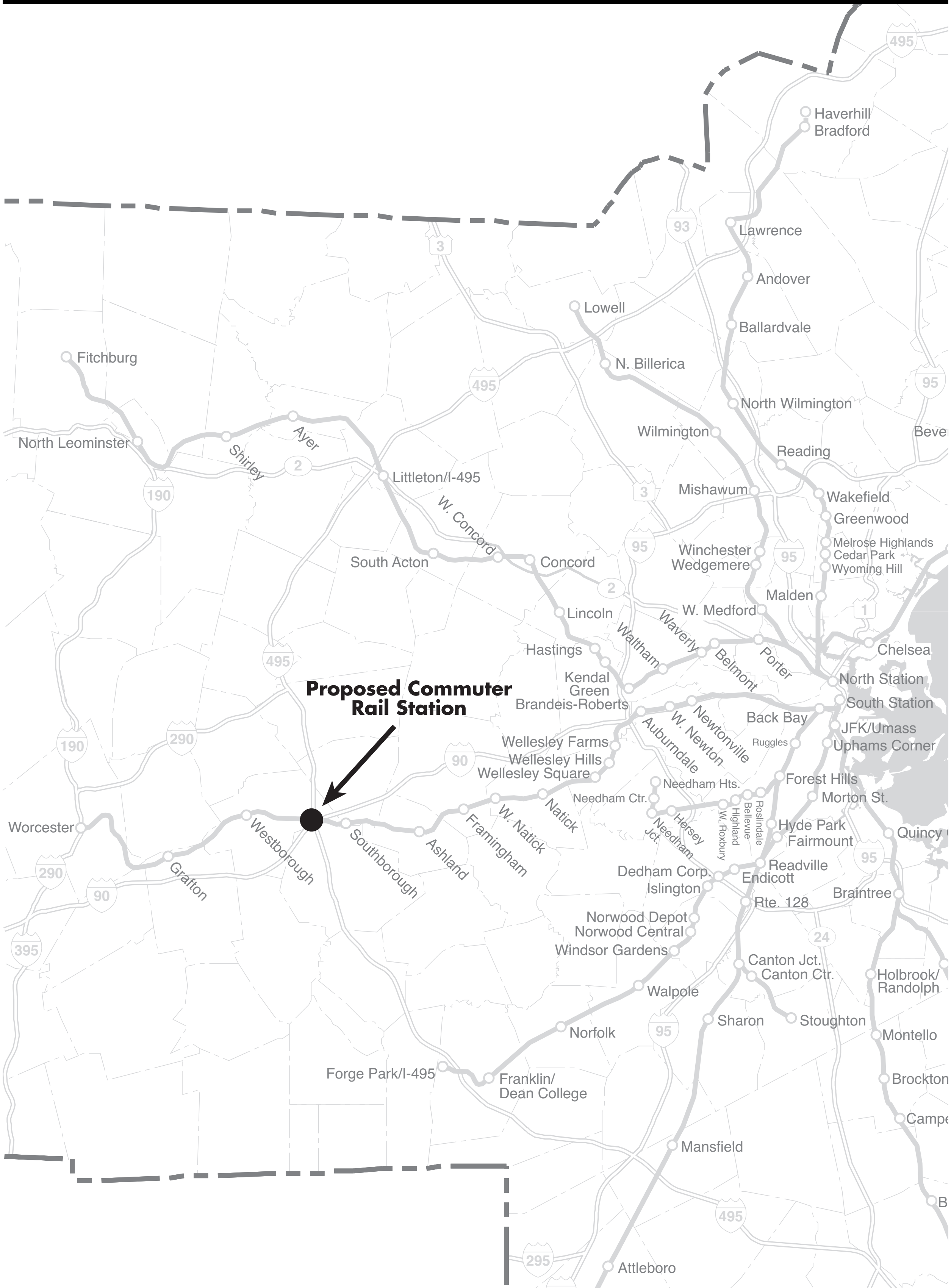
Capital Cost	**$4.1 million (CTPS estimate)**
Operating Cost	**Too small to calculate**
Daily Ridership Increase on Mode	**70**
Net Increase in Daily Transit Ridership	**50**
Capital Cost per New Transit Rider	**$81,300**
Operating Cost per Wkday/New Transit Rider	**Too small to calculate**
Capital Cost/Travel Time Benefit	**$223,800 per hour**
Operating Cost/Travel Time Benefit	**Too small to calculate**
Travel Time Savings	**18 hours per weekday**

Assessment

Overall, this project is rated medium priority. It would attract few total riders or new transit riders. The capital cost would also be relatively small in absolute terms, but the cost per new rider would be at the upper end of the mid-range among commuter rail expansion projects analyzed. Because of the relatively small saving in VMT for each new transit user, cost-effectiveness of air quality improvements would be only moderate. The Allston location does, however, receive a high rating for economic and land-use impacts, because it would be in a state-designated revitalization area, where local plans call for new industrial and high-density residential development. It would also introduce one-seat rail service to downtown Boston from an environmental justice target neighborhood that does not currently have rapid transit service.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Economic/ Land Use Impacts	Environ. Justice
New Station	○	◗	◗	◗	○	●	●

MAP 5C-23 BUILD COMMUTER RAIL STATION ON I-495 IN METROWEST AREA



D BUILD COMMUTER RAIL STATION ON I-495 IN METROWEST AREA

Description

This project would add a new station on the Framingham/Worcester commuter rail line at Route I-495 in Westborough, between the existing Westborough and Southborough Stations. Both of those stations opened in 2002. Previous commuter rail stations in both towns had been discontinued in 1960.

Capital Features

This project would consist of one new station with a regional parking facility on an existing line. No upgrading of tracks would be needed. Peak capacity would need to be increased by six coaches. A new highway interchange would be needed for access to the station.

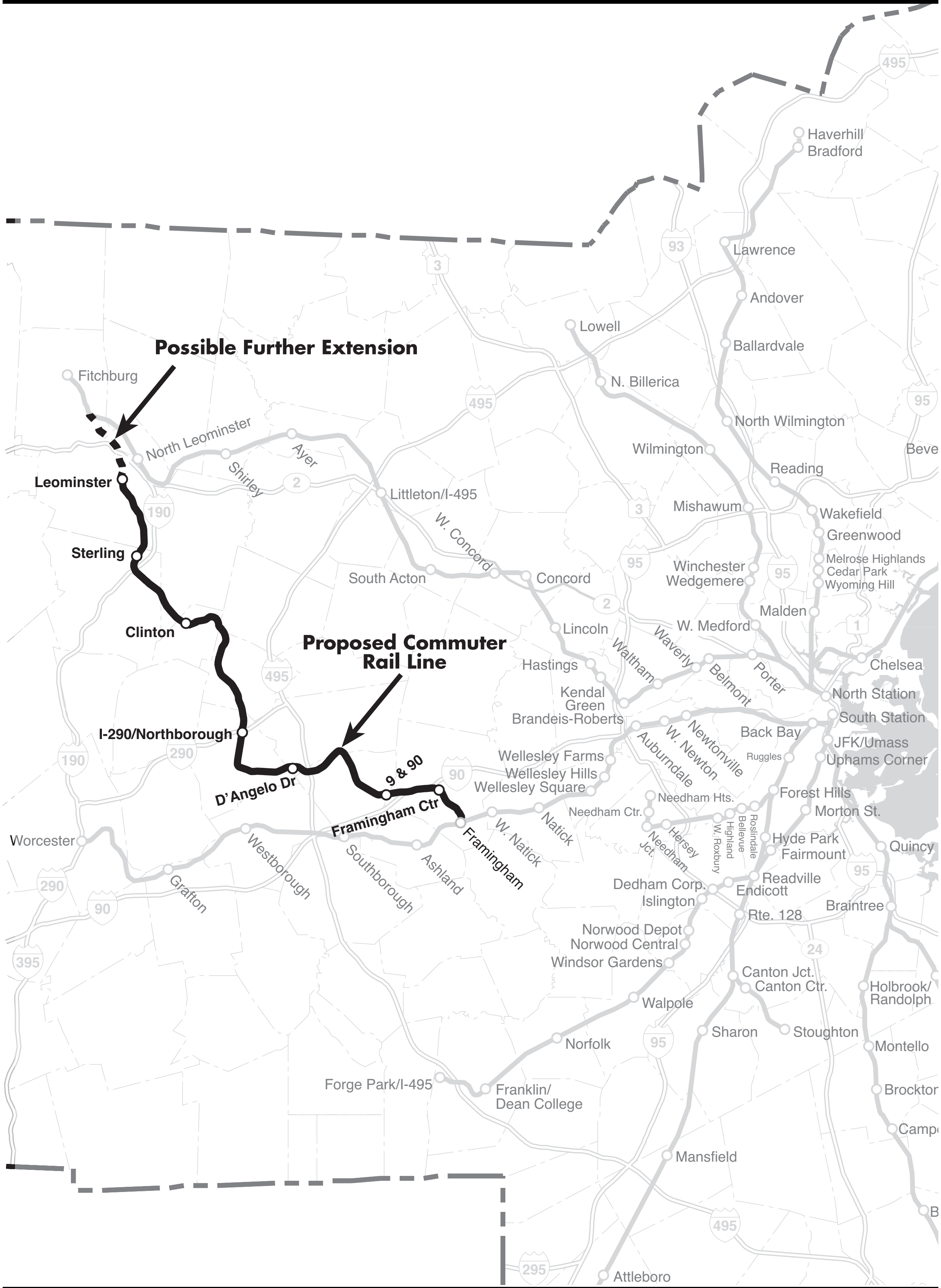
Capital Cost	**$111.1 million (CTPS estimate)**
Operating Cost	**Increased fuel from extra starts and stops, too small to calculate**
Daily Ridership Increase on Mode	**1,500**
Net Increase in Daily Transit Ridership	**900**
Capital Cost per New Transit Rider	**$122,100**
Operating Cost per Wkday/New Transit Rider	**Too small to calculate**
Capital Cost/Travel Time Benefit	**$449,000 per hour**
Operating Cost/Travel Time Benefit	**Too small to calculate**
Travel Time Savings	**247 hours per weekday**

Assessment

Overall, this project is rated medium priority. New transit ridership would fall near the lower end of the mid-range among commuter rail projects analyzed for the PMT. It would not require any track upgrading, but because it would require construction of a new highway interchange, it would also fall near the lower end of the mid-range with respect to cost effectiveness. The project has a low rating for economic and land-use impacts, as it would not satisfy any of the goals in that category. It would not serve any environmental justice target communities.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Economic/ Land Use Impacts	Environ. Justice
New Station	◗	❍	◗	●	❍	❍	❍

MAP 5C-24 COMMUTER RAIL LINE FROM FRAMINGHAM TO LEOMINSTER



D COMMUTER RAIL LINE FROM FRAMINGHAM TO LEOMINSTER

Description

This project would implement passenger service on an existing rail freight line that connects with the Framingham/Worcester Line at Framingham Station. Passenger service was last operated on the southern end of this route in 1937, and on the remainder in 1931. The MBTA completed work in 2001 on a feasibility study that examined a commuter rail extension from Framingham to Northborough. That study provides detailed cost and ridership information for that segment of this larger service corridor.

Capital Features

This would be a 33-mile extension, including seven new stations, in Framingham, Marlborough, Northborough, Clinton, Sterling, and Leominster. Extensive upgrading of tracks and signals would be required.

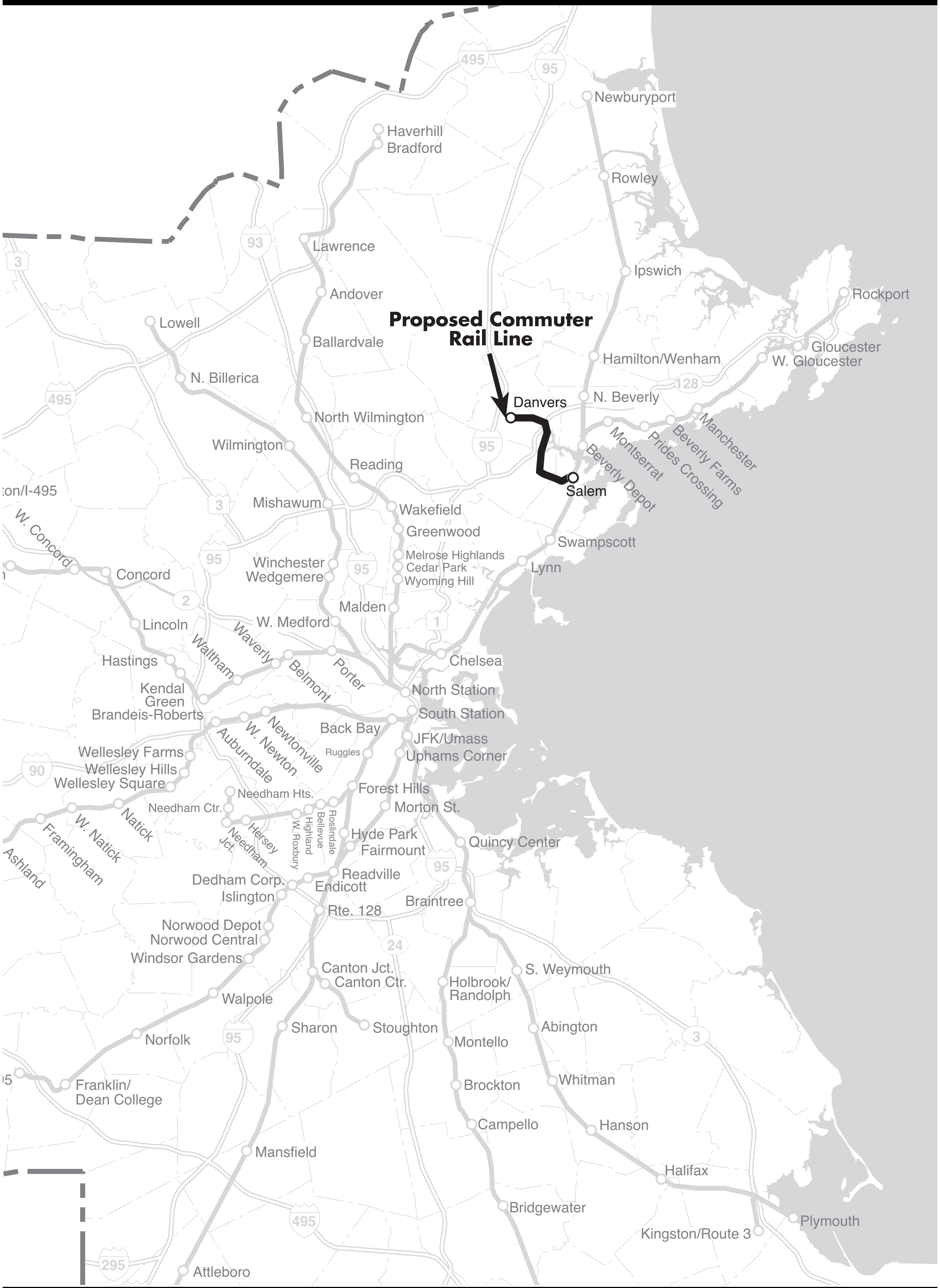
Capital Cost	**$375.4 million (CTPS estimate)**
Operating Cost	**$93,700 per weekday**
Daily Ridership Increase on Mode	**3,000**
Net Increase in Daily Transit Ridership	**1,300**
Capital Cost per New Transit Rider	**$282,300**
Operating Cost per Wkday/New Transit Rider	**$70.40**
Capital Cost/Travel Time Benefit	**$640,100 per hour**
Operating Cost/Travel Time Benefit	**$159.70 per hour**
Travel Time Savings	**587 hours per weekday**

Assessment

The overall rating of this project is medium priority. It would be one of the better commuter rail expansion projects examined in terms of the numbers of new transit riders and total riders served, and would serve an area with very limited existing transit service. Nevertheless, it would rate poorly in terms of capital and operating costs per new transit rider. Benefits to air quality would be very limited, with moderate reductions in emissions of CO and CO2, but increases in emissions of NOx and VOC. Ridership would consist predominantly of work trips from homes in or near the communities with stations to employment locations in Boston or Cambridge. Some of the communities that would be served have had substantial growth in employment in office or industrial parks in recent years. Attraction of reverse commuters and local trips on the extension would, however, require implementation of an extensive network of feeder services because of the distance from the rail line to major trip attractions. Costs of such service are not included above.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Economic/ Land Use Impacts	Environ. Justice
Line Extension	●	●	❍	❍	❍	●	◗

MAP 5C-25 COMMUTER RAIL LINE FROM SALEM TO DANVERS



D COMMUTER RAIL LINE FROM SALEM TO DANVERS

Description

This project would implement passenger service on a combination of active and inactive rail freight lines from Salem Station on the Newburyport/Rockport Line through Peabody to Danvers. Passenger service was last operated on this line in 1959. This project is currently being evaluated in the North Shore Major Investment Study which will provide more detailed information about its impacts.

Capital Features

This would be a five-mile extension, including two new stations, in Peabody and Danvers. Extensive upgrading of tracks and signals would be required. A new bridge across the Waters River in Danvers would be needed to replace a damaged wooden trestle.

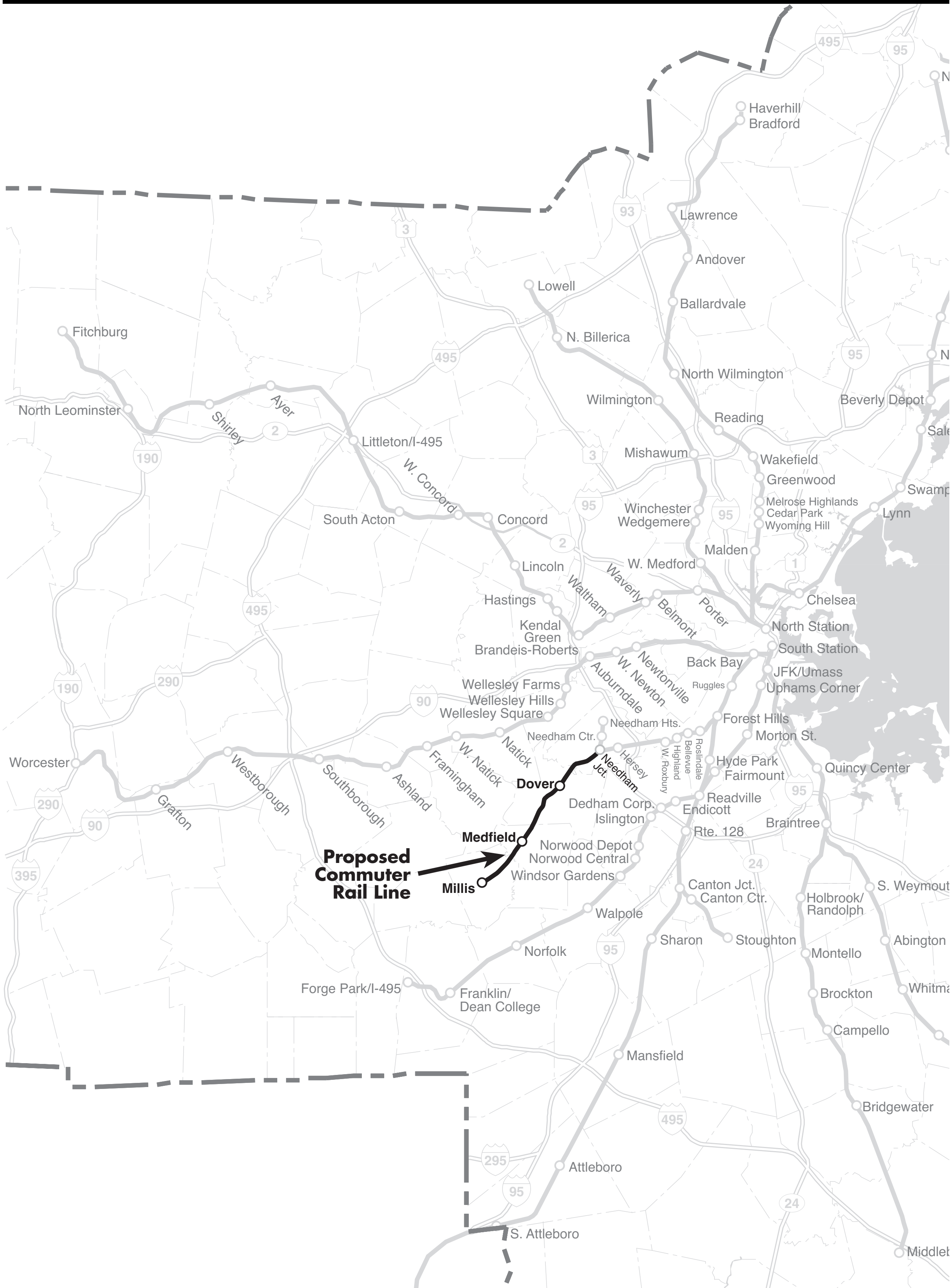
Capital Cost	**$56.1 million (CTPS estimate)**
Operating Cost	**$10,900 per weekday (limited frequency service)**
Daily Ridership Increase on Mode	**1,700**
Net Increase in Daily Transit Ridership	**700**
Capital Cost per New Transit Rider	**$80,000**
Operating Cost per Wkday/New Transit Rider	**$15.50**
Capital Cost/Travel Time Benefit	**$207,000 per hour**
Operating Cost/Travel Time Benefit	**$40.60 per hour**
Travel Time Savings	**271 hours per weekday**

Assessment

The overall rating of this project is medium priority. It would be moderately successful in attracting riders. The areas it would serve have limited direct transit service but are fairly close to existing stations on the Newburyport/Rockport Line. Capital costs for this project would be in the mid-range of costs among commuter rail extensions examined. Capital and operating costs per new transit rider would also be in the mid-range for commuter rail projects. It would have only a moderate impact on air quality. Emissions of CO, CO_2, and VOC would be reduced, but those of NOx would increase. Coordination of schedules of Danvers trains with those of Newburyport and Rockport trains between Salem and Boston could be difficult. Shuttle trains between Salem and Danvers could prove to be preferable to through trains from Danvers to Boston both from an operations standpoint and in quality of service provided.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Economic/ Land Use Impacts	Environ. Justice
Line Extension	◗	●	◗	◗	❍	❍	◗

MAP 5C-26 COMMUTER RAIL FROM NEEDHAM JUNCTION TO MILLIS



D COMMUTER RAIL FROM NEEDHAM JUNCTION TO MILLIS

Description

This project would implement passenger service on an existing rail freight line from Needham Junction Station on the Needham Line to Millis. Passenger service was last operated on this line in 1967.

Capital Features

This would be a ten-mile extension, including three new stations, in Dover, Medfield, and Millis. Extensive upgrading of tracks and signals would be required.

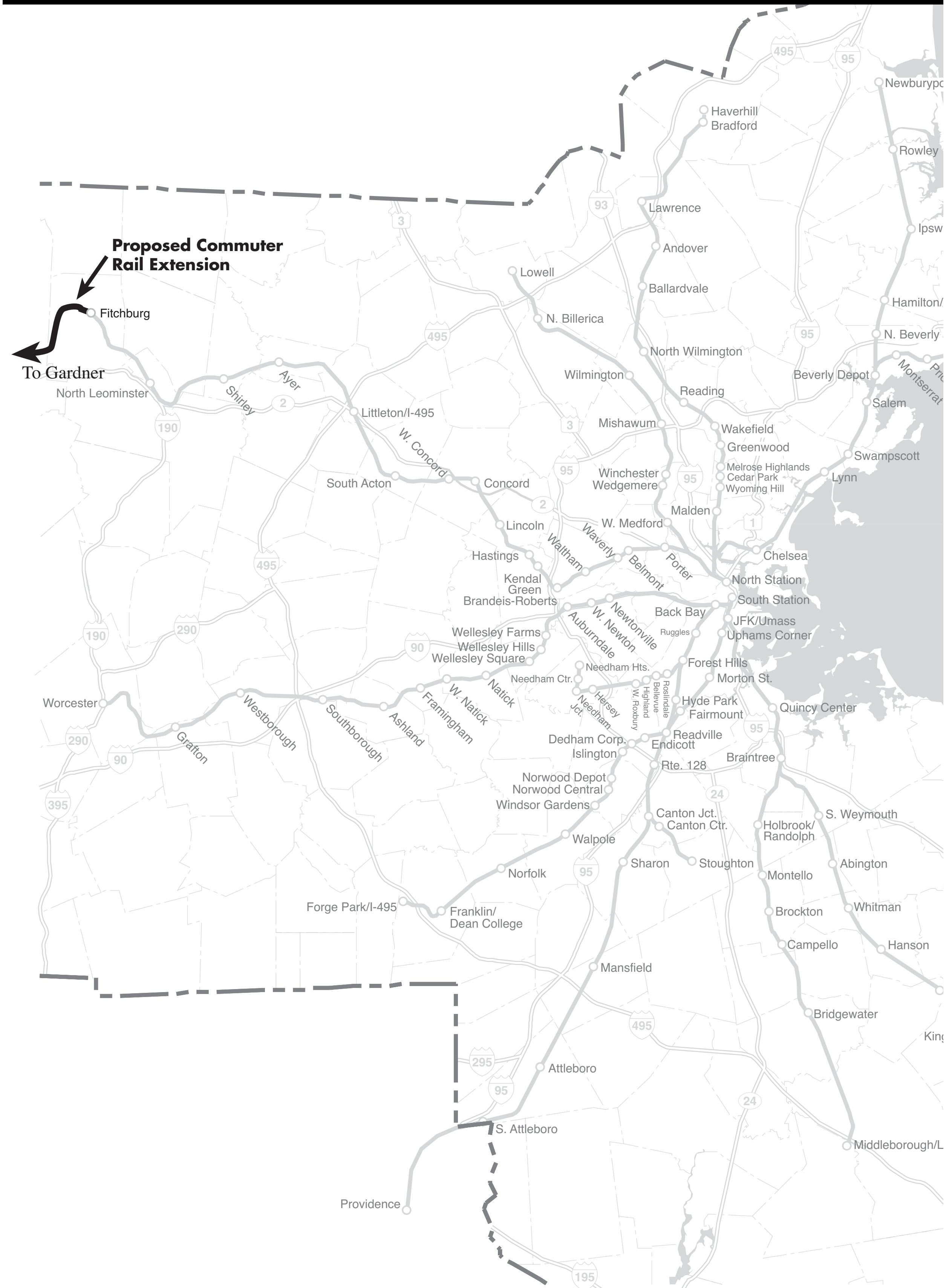
Capital Cost	**$128.8 million (Based on 1998 Millis Feasibility Study, adjusted to 2003)**
Operating Cost	**$35,800 per weekday**
Daily Ridership Increase on Mode	**4,000**
Net Increase in Daily Transit Ridership	**2,700**
Capital Cost per New Transit Rider	**$47,700**
Operating Cost per Wkday/New Transit Rider	**$13.30**
Capital Cost/Travel Time Benefit	**$334,900 per hour**
Operating Cost/Travel Time Benefit	**$93.60 per hour**
Travel Time Savings	**385 hours per weekday**

Assessment

The overall rating of this project is medium priority. It would be one of the more successful commuter rail expansion projects in attracting riders, but capital costs would be at the upper end of the mid-range among extensions examined. Therefore it would have a medium rating in terms of capital and operating costs per new transit rider. Some of the new ridership would be attracted by increased frequency and faster travel times at existing Needham Line stations, and the same improvements could be made without a Millis extension. Emissions of CO, CO2, and VOC would be reduced, but those of NOx would increase. The overall impact on air quality would be medium. This project would not serve any environmental justice target communities.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Economic/ Land Use Impacts	Environ. Justice
Line Extension	●	●	◗	◗	❍	❍	❍

MAP 5C-27 EXTEND COMMUTER RAIL FROM FITCHBURG TO GARDNER



D EXTEND COMMUTER RAIL FROM FITCHBURG TO GARDNER

Description

This project would implement commuter service on an existing rail freight line from the end of the Fitchburg Line to Gardner. Passenger service was last operated on this line in 1986.

Capital Features

This would be a 15.6-mile extension, including one new station in Gardner with parking facilities. Extensive upgrading of tracks and signals would be required.

Capital Cost	**\$104.2 million (CTPS estimate)**
Operating Cost	**\$16,900 per weekday**
Daily Ridership Increase on Mode	**50**
Net Increase in Daily Transit Ridership	**50**
Capital Cost per New Transit Rider	**\$2,084,200**
Operating Cost per Wkday/New Transit Rider	**\$337.70**
Capital Cost/Travel Time Benefit	**\$5,437,100 per hour**
Operating Cost/Travel Time Benefit	**\$887.00 per hour**
Travel Time Savings	**19 hours per weekday**

Assessment

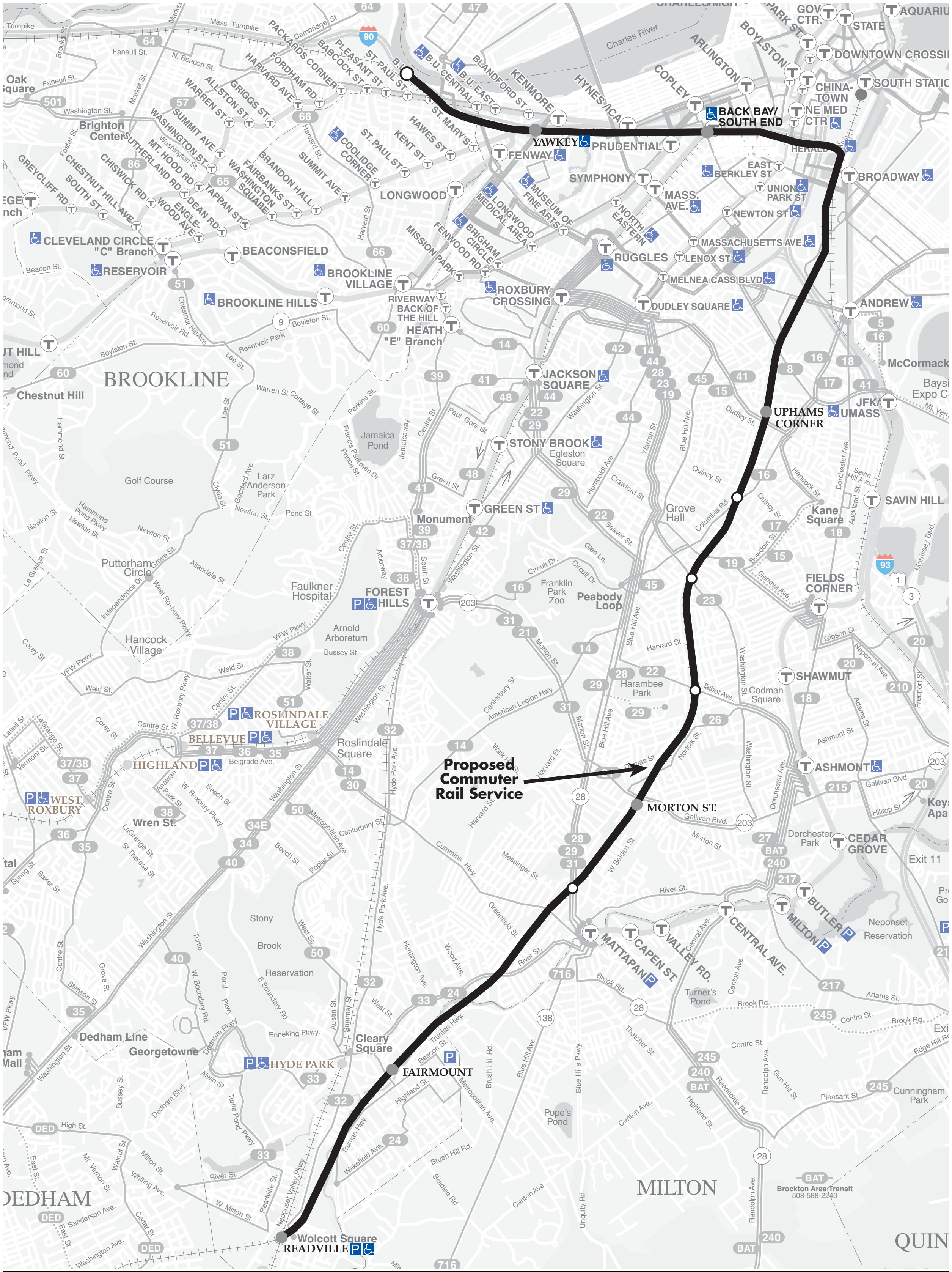
Overall, this project is rated medium priority. It would extend direct rail transit service to an area that currently has only an infrequent feeder bus connection to rail service at Fitchburg. It would, however, attract few riders, resulting in the highest capital and operating costs per new transit rider of any commuter rail expansion project analyzed for the PMT. It would be of little benefit to air quality, reducing emissions of CO and CO2, slightly, while increasing those of VOC and NOx.

Fitchburg and Gardner are located on opposite sides of the Wachusett Mountain range. In order to maintain acceptable grades, the rail line between them is 35% longer than the state highway. The fastest feasible train time from Gardner to Fitchburg would be 20 minutes.

This project has substantial support from local elected officials, as reflected in their Regional Transportation Plan. It is viewed as a means of facilitating access to older urban centers with substantial low-income populations and as a tool for economic development. The Gardner station would be in a state-designated revitalization area.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Economic/ Land Use Impacts	Environ. Justice
Line Extension	❍	●	❍	❍	❍	●	◗

MAP 5C-28 OPERATE HIGH-FREQUENCY READVILLE–ALLSTON LANDING COMMUTER RAIL SERVICE



D

OPERATE HIGH-FREQUENCY READVILLE-ALLSTON LANDING COMMUTER RAIL SERVICE

Description

This project would institute new commuter rail service between Readville Station and a new station in Allston using portions of the routes of the Fairmount Line and the Framingham/Worcester Line, but bypassing South Station. This service would be in addition to rather than in place of other service on those lines.

Capital Features

This project would consist of new service over existing lines. It would require one new station, at Allston Landing, and four new train sets. The cost calculations assume that these would each be two-car diesel multiple unit (DMU) trains.

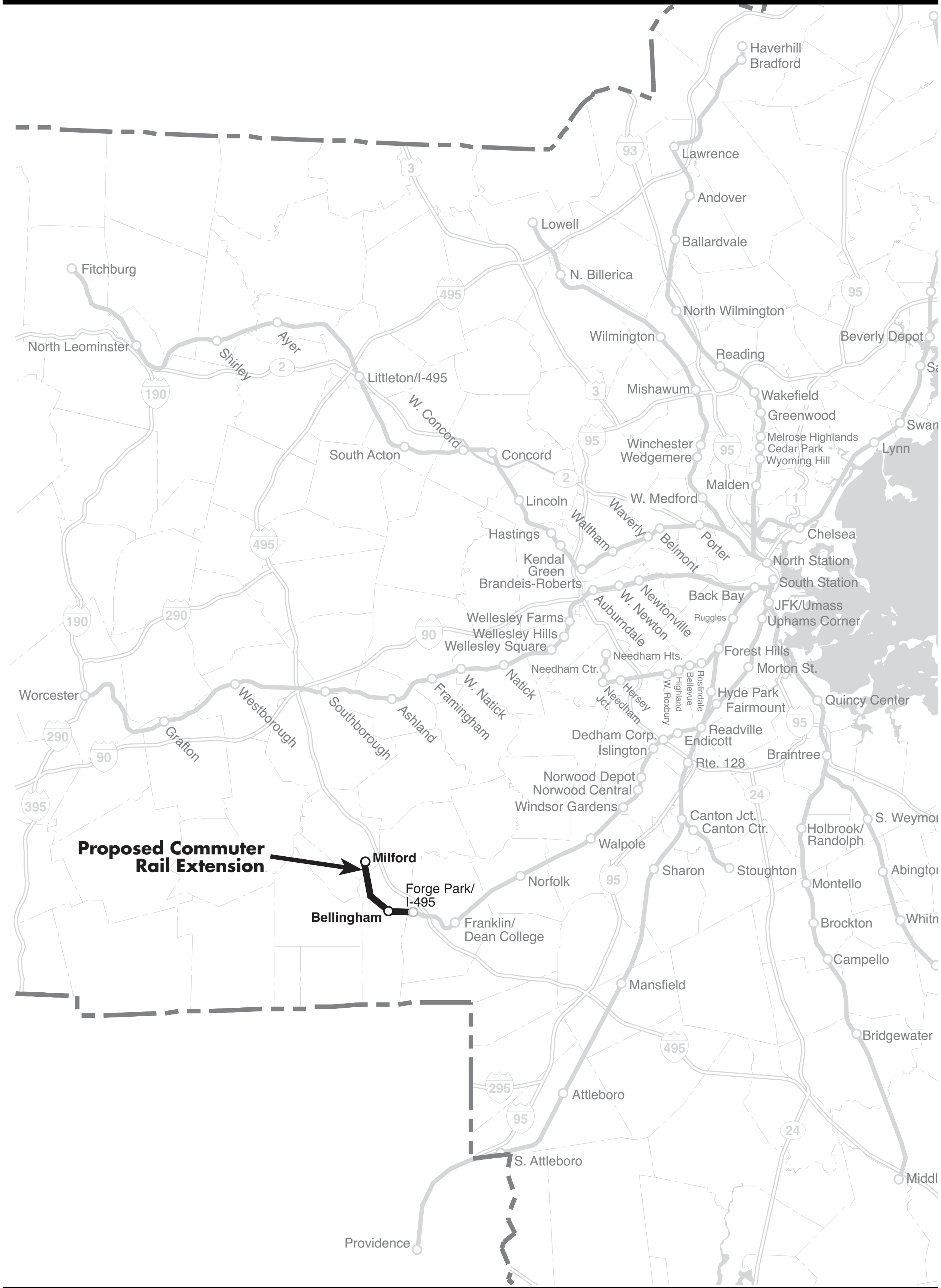
Capital Cost	**$34.3 million (CTPS estimate)**
Operating Cost	**$16,200 per day**
Daily Ridership Increase on Mode	**900**
Net Increase in Daily Transit Ridership	**80**
Capital Cost per New Transit Rider	**$428,600**
Operating Cost per Wkday/New Transit Rider	**$201.90**
Capital Cost/Travel Time Benefit	**$482,900 per hour**
Operating Cost/Travel Time Benefit:	**$228.60 per hour**
Travel Time Savings	**71 hours per weekday**

Assessment

Overall, this project is rated medium priority. It would attract relatively low numbers of total riders or new transit riders. The capital cost would be near the lower end of the mid-range among commuter rail projects in absolute terms, but because of the limited ridership, the cost per new rider would be among the highest for all such projects. Likewise, the absolute operating cost would be relatively low, but the cost per new transit rider would be high. Because most of the riders would be diverted from other transit services, and the route would be operated with internal combustion powered trains, it would result in a net worsening of air quality. The main benefit of this project would be in providing new through service between two environmental justice target areas. It would, however, be among the more costly projects in both capital and operating cost per hour of travel time saved per day. Routing conflicts between this service and other South Side commuter rail routes could result in an overall degradation of service on the system.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Economic/ Land Use Impacts	Environ. Justice
Line Extension	❍	◗	❍	❍	❍	●	●

MAP 5C-29 EXTEND COMMUTER RAIL FROM FORGE PARK TO MILFORD



D EXTEND COMMUTER RAIL FROM FORGE PARK TO MILFORD

Description

This project would implement commuter service on an existing rail freight line from the end of the Franklin Line to Milford. Extensive upgrading of tracks and signals would be required. Passenger service was last operated on the inner end of this line in 1940 and on the outer end in 1920.

Capital Features

This would be a six-mile extension, including two new stations, in Bellingham and in Milford. Extensive upgrading of tracks and signals would be required.

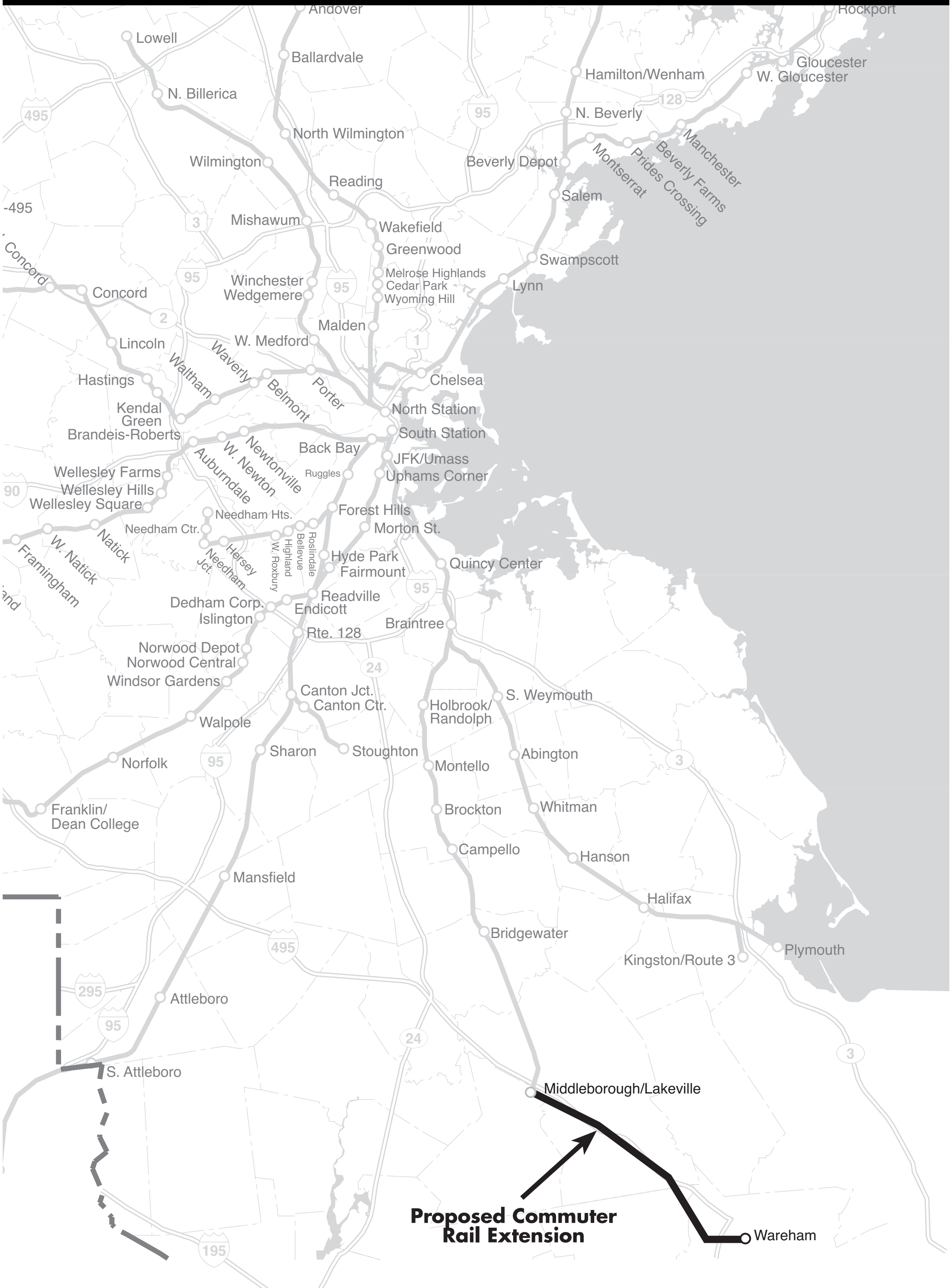
Capital Cost	**$70.5 million (CTPS estimate)**
Operating Cost	**$10,100 per weekday**
Daily Ridership Increase on Mode	**1,800**
Net Increase in Daily Transit Ridership	**800**
Capital Cost per New Transit Rider	**$93,100**
Operating Cost per Wkday/New Transit Rider	**$13.20**
Capital Cost/Travel Time Benefit	**$227,100 per hour**
Operating Cost/Travel Time Benefit	**$32.20 per hour**
Travel Time Savings	**310 hours per weekday**

Assessment

The overall rating of this project is medium priority. It would be moderately successful in attracting riders. The areas it would serve have very limited direct transit service but are fairly close to the present end of the Franklin Line at Forge Park. Capital costs for this project would be in the mid-range of costs among commuter rail extensions examined. It would be among the more cost-effective projects in terms of capital and operating costs per new transit rider. It would be in the mid-range of projects in terms of air quality impacts. Emissions of CO, CO2, and VOC would be reduced, but those of NOx would increase. It is rated low in economic and land use impacts. A downtown Milford station would serve a state-designated revitalization area, but there are no current plans for new high-density development there.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Economic/ Land Use Impacts	Environ. Justice
Line Extension	◗	●	◗	◗	❍	❍	◗

MAP 5C-30 EXTEND COMMUTER RAIL FROM MIDDLEBOROUGH TO WAREHAM



D EXTEND COMMUTER RAIL FROM MIDDLEBOROUGH TO WAREHAM

Description

This project would extend commuter rail along an existing rail freight line from the end of the Middleborough/Lakeville Line to Wareham. Through passenger service from Wareham to Boston on this route was last operated in 1959. During summer months from 1984 to 1988 connecting service was operated from Cape Cod and Wareham to the Braintree Red Line station.

Capital Features

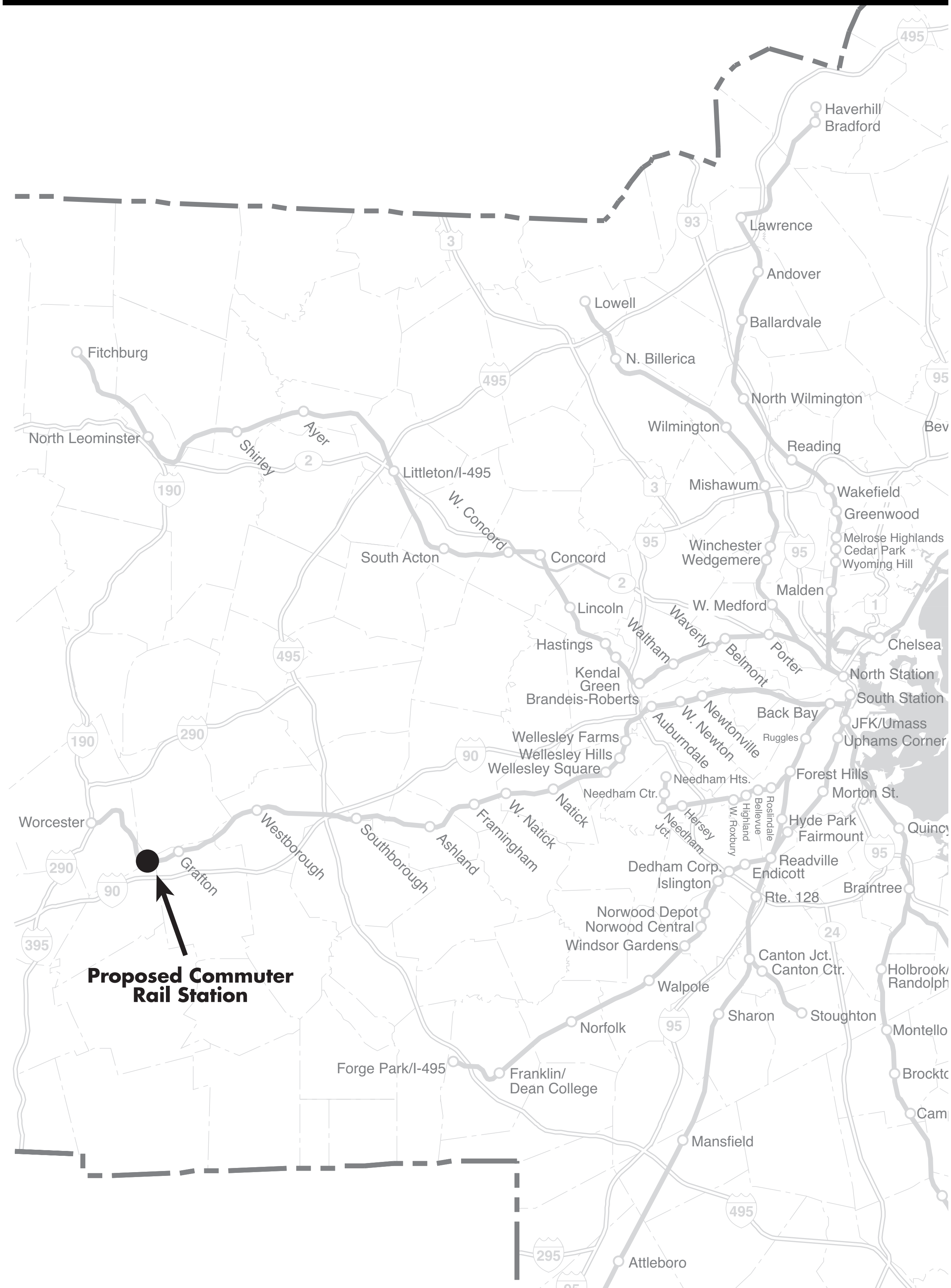
This would be a 13.5-mile extension, with one new station, including a park-and-ride lot. This line was extensively rehabilitated in the 1980s for seasonal intercity passenger service. Upgrading for commuter rail service would include completion of a signal system that is already partly in place and some replacement of ties. Increased running time would require one additional train set to maintain schedules.

Capital Cost	**$35.8 million (CTPS estimate)**
Operating Cost	**$16,500 per weekday**
Daily Ridership Increase on Mode	**1,300**
Net Increase in Daily Transit Ridership	**420**
Capital Cost per New Transit Rider	**$85,200**
Operating Cost per Wkday/New Transit Rider	**$39.20**
Capital Cost/Travel Time Benefit	**$179,400 per hour**
Operating Cost/Travel Time Benefit	**$82.50 per hour**
Travel Time Savings	**200 hours per weekday**

Assessment

The overall rating of this project is medium priority. Ridership would be near the lower end of the mid-range among commuter rail extension projects examined, but many of the riders would be diverted from other transit services. Wareham itself has very limited express bus service to Boston, but towns south of the Cape Cod Canal from which the extension could draw riders have frequent express bus service. Capital costs for this project would be near the lower end of the mid-range of costs among commuter rail extensions examined, but because of the limited ridership, capital cost per new rider would be among the highest for projects with similar absolute costs. Operating cost per new rider would also be relatively high. The project would have only a moderate impact on air quality. Emissions of CO, CO2, and VOC would be reduced, but those of NOx would increase.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Economic/ Land Use Impacts	Environ. Justice
Line Extension	◗	●	❍	◗	❍	◗	❍


Proposed Commuter Rail Station
Haverhill
Bradford
Lawrence
Andover
Ballardvale
Lowell
N. Billerica
North Wilmington
Wilmington
Reading
Fitchburg
North Leominster
Shirley
Ayer
Littleton/I-495
W. Concord
South Acton
Concord
Mishawum
Wakefield
Greenwood
Melrose Highlands
Cedar Park
Wyoming Hill
Winchester
Wedgemere
Malden
Lincoln
W. Medford
Hastings
Waltham
Waverly
Belmont
Porter
Chelsea
Kendal Green
Brandeis-Roberts
North Station
South Station
Back Bay
Newtonville
W. Newton
Auburndale
JFK/Umass
Ruggles
Uphams Corner
Wellesley Farms
Wellesley Hills
Wellesley Square
Needham Hts.
Needham Ctr.
Forest Hills
Morton St.
Worcester
Westborough
Southborough
Ashland
Framingham
W. Natick
Natick
Hersey
Needham Jct.
W. Roxbury
Highland
Bellevue
Roslindale
Hyde Park
Fairmount
Quincy
Grafton
Readville
Endicott
Dedham Corp.
Islington
Braintree
Rte. 128
Norwood Depot
Norwood Central
Windsor Gardens
Canton Jct.
Canton Ctr.
Holbrook/Randolph
Walpole
Sharon
Stoughton
Norfolk
Forge Park/I-495
Franklin/Dean College
Mansfield
Attleboro

D

NEW STATION AT MILLBURY ON FRAMINGHAM/WORCESTER LINE

Description

This project would add a new commuter rail station on the Framingham/ Worcester commuter rail line in Millbury, near Massachusetts Turnpike Interchange 11. It would be between the existing Worcester and Grafton stations.

Capital Features

This project would consist of one new station with a regional parking facility on an existing line. No upgrading of tracks would be needed. Peak capacity would need to be increased by one coach. A new access road would be needed to reach the site from the nearest highway, but the cost of that has not been calculated.

Capital Cost	**$7.4 million (CTPS estimate)**
Operating Cost	**Increased fuel from extra starts and stops, too small to calculate.**
Daily Ridership Increase on Mode	**300**
Net Increase in Daily Transit Ridership	**140**
Capital Cost per New Transit Rider	**$52,900**
Operating Cost per Wkday/New Transit Rider	**Too small to calculate**
Capital Cost/Travel Time Benefit	**$119,000 per hour**
Operating Cost/Travel Time Benefit	**Too small to calculate**
Travel Time Savings	**62 hours per weekday**

Assessment

Overall, this project is rated medium priority. It would attract a relatively small number of riders. Nevertheless, because it would not require any upgrading of track, it would rank high on cost-effectiveness among commuter rail projects relative to new ridership and to air quality improvements. The largest sources of ridership at this station would be expected to be the towns of Millbury and Auburn, and the southeast corner of the city of Worcester. The towns of Sutton, Oxford, Webster, Dudley, Douglas, and Charlton would also originate a few trips each. Ridership from more distant points would be too small to enumerate.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Economic/ Land Use Impacts	Environ. Justice
New Station	❍	◗	●	◗	❍	●	❍


Newburyport
Haverhill
Bradford
Rowley
Lawrence
Ipswich
Andover
Rockport
Lowell
Ballardvale
Hamilton/Wenham
Gloucester
W. Gloucester
N. Billerica
N. Beverly
North Wilmington
Wilmington
Beverly Depot
Montserrat
Prides Crossing
Beverly Farms
Manchester
Reading
Salem
Mishawum
Wakefield
Greenwood
Proposed Commuter Rail Station
Swampscott
Melrose Highlands
Cedar Park
Wyoming Hill
Lynn
Winchester
Wedgemere
Concord
Malden
Lincoln
W. Medford
Waltham
Waverly
Belmont
Porter
Chelsea
Hastings
Kendal Green
Brandeis-Roberts
North Station
South Station
Back Bay
Newtonville
W. Newton
Auburndale
JFK/Umass
Ruggles
Uphams Corner
Wellesley Farms
Wellesley Hills
Wellesley Square
Needham Hts.
Forest Hills
Needham Ctr.
Morton St.
Natick
W. Natick
Hersey
Needham Jct.
W. Roxbury
Highland
Bellevue
Roslindale
Hyde Park
Fairmount
Quincy Center
Readville
Dedham Corp.
Endicott
Islington
Braintree
Rte. 128
Norwood Depot
Norwood Central
Windsor Gardens
Canton Jct.
Canton Ctr.
S. Weymouth
Holbrook/Randolph
N. Abington
Walpole
Sharon
Stoughton
Norfolk
Montello
Franklin/Dean College
Brockton
Whitman
Campello
Mansfield
S. Hanson
Halifax
495
95
93
128
3
2
1
24

D

NEW STATION AT SOUTH SALEM ON ROCKPORT/NEWBURYPORT LINE

Description

This project would add a new station on the Newburyport/Rockport commuter rail line south of downtown Salem, between the existing Salem and Swampscott stations. A previous station known as Castle Hill at about the same location was discontinued in the 1950s, and had been served mostly by trains on a branch to Marblehead that diverged there.

Capital Features

This project would consist of one new station on an existing line. No upgrading of tracks would be needed. Peak capacity would need to be increased by three coaches.

Capital Cost	**$8.2 million (MBTA Planning Dept. estimate)**
Operating Cost	**Increased fuel from extra starts and stops, too small to calculate.**
Daily Ridership Increase on Mode	**1,100**
Net Increase in Daily Transit Ridership	**840**
Capital Cost per New Transit Rider	**$9,800**
Operating Cost per Wkday/New Transit Rider	**Too small to calculate**
Capital Cost/Travel Time Benefit	**$80,400 per hour**
Operating Cost/Travel Time Benefit	**Too small to calculate**
Travel Time Savings	**102 hours per weekday**

Assessment

Overall, this project is rated medium priority. It would provide direct commuter rail service to a section of Salem now served by a bus route that can also be used as a commuter rail connection. It would attract only a moderate amount of new transit ridership, but because no upgrading of track would be required, the capital cost per new rider would be among the lowest of all commuter rail expansion projects analyzed for the PMT. It would have medium ratings in terms of environmental justice and economic/land use impacts. It would be located in a state-designated revitalization area, and it would improve access to Salem State College, a major institution of higher education. The new station would have a positive effect on air quality, and would be among the more cost-effective commuter rail projects with respect to these improvements.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Economic/Land Use Impacts	Environ. Justice
New Station	❍	◗	●	●	❍	◗	◗

MAP 5C-33 CONNECT FITCHBURG CRR LINE WITH RED LINE AT ALEWIFE

D CONNECT FITCHBURG COMMUTER RAIL LINE WITH RED LINE AT ALEWIFE

Description

This project would add a new station on the Fitchburg commuter rail line near the Alewife Red Line station in Cambridge, between the existing Porter Square Station in Cambridge and Belmont Station. A previous station at this location was discontinued in 1938.

Capital Features

This project would consist of one new station on an existing line. No upgrading of tracks and no rolling stock would be needed, but a pedestrian connection between the commuter rail station and the Red Line station would have to be provided. Costs for this connection have not been included.

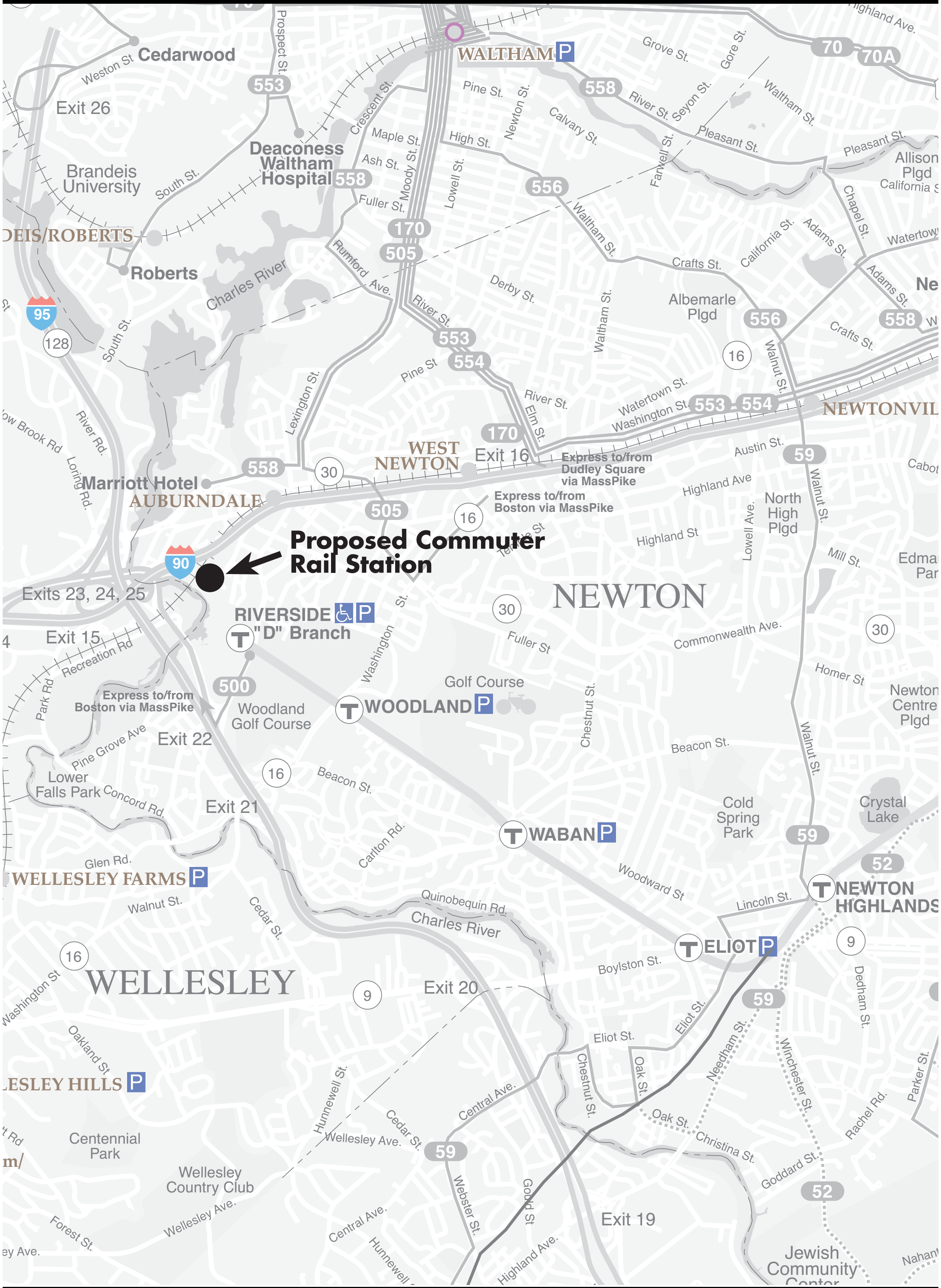
Capital Cost	**$4.1 million (CTPS estimate)**
Operating Cost	**Increased fuel from extra starts and stops, too small to calculate.**
Daily Ridership Increase on Mode	**60**
Net Increase in Daily Transit Ridership	**40**
Capital Cost per New Transit Rider	**$101,600, excluding cost of pedestrian connection**
Operating Cost per Wkday/New Transit Rider	**Too small to calculate**
Capital Cost/Travel Time Benefit	**$1,219,700 per hour**
Operating Cost/Travel Time Benefit	**Too small to calculate**
Travel Time Savings	**3 hours per weekday**

Assessment

Overall, this project is rated medium priority. It would attract very few total riders or new transit riders. The capital cost would be relatively small in absolute terms, but because of the low ridership, the cost per new rider would be at the upper end of the mid-range of such costs among commuter rail expansion projects. It would receive a high rating for economic and land-use impacts, because it would be in a state-designated revitalization area, where local plans call for new mixed-use development, including an office park on a brownfield site along with commercial and residential construction.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Economic/ Land Use Impacts	Environ. Justice
New Station	❍	❍	◗	◗	◗	●	❍

MAP 5C-34 NEW COMMUTER RAIL STATION AT RIVERSIDE



D NEW COMMUTER RAIL STATION AT RIVERSIDE

Description

This project would add a new station on the Framingham/ Worcester commuter rail line near Route 128 on the border of Newton and Weston. It would be between the existing Wellesley Farms and Auburndale stations, possibly replacing the latter. A previous commuter rail station in this vicinity was discontinued in 1977 because of very low ridership.

Capital Features

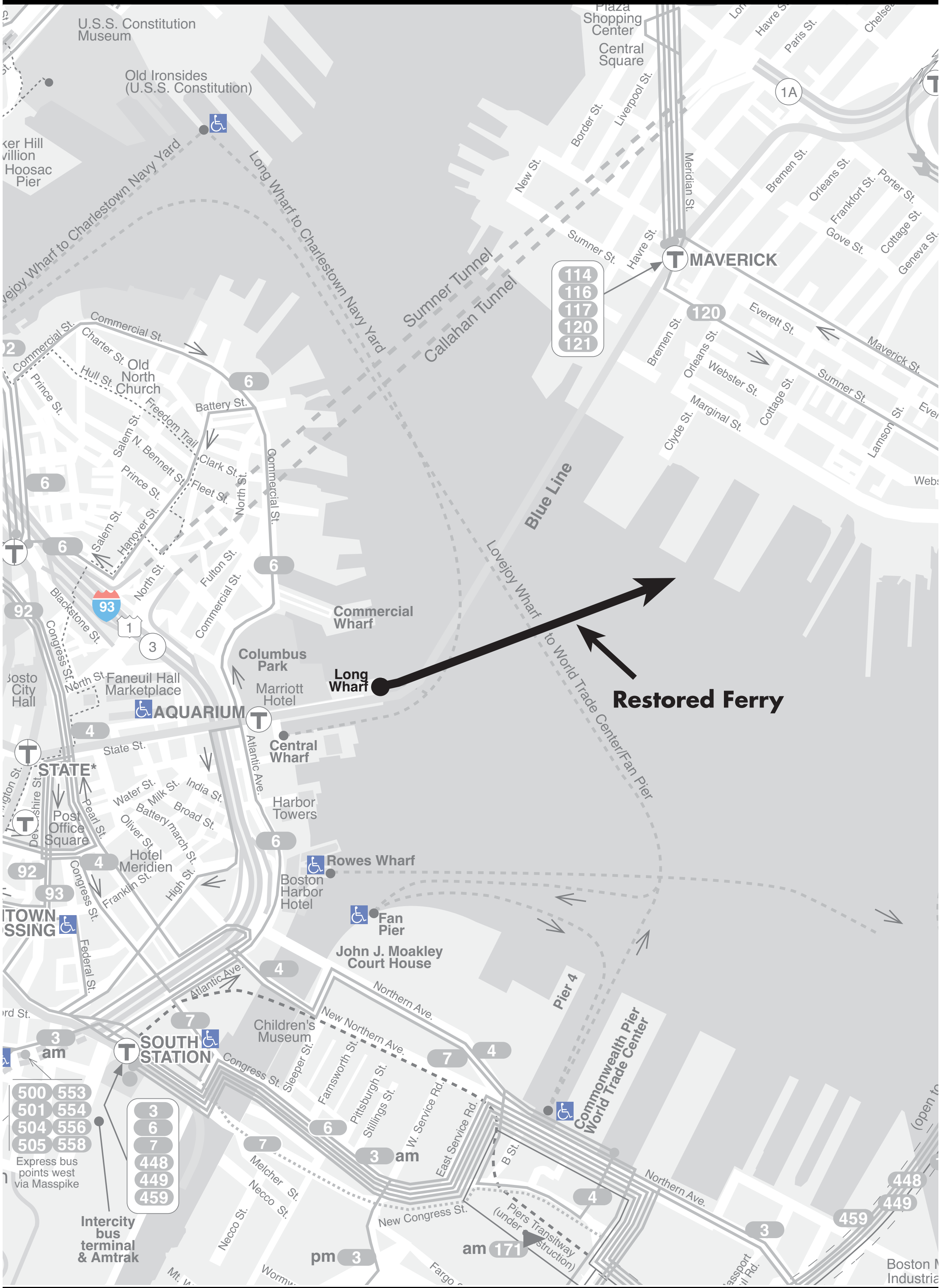
This project would consist of one new station with a regional parking facility on an existing line. No upgrading of tracks would be needed. Peak capacity would need to be increased by two coaches. A new or upgraded access road would be needed to reach the site from Route 128, but the cost of that has not been calculated.

Capital Cost	**$10.7 million (CTPS estimate)**
Operating Cost	**Too small to calculate**
Daily Ridership Increase on Mode	**700**
Net Increase in Daily Transit Ridership	**250**
Capital Cost per New Transit Rider	**$43,000**
Operating Cost per Wkday/New Transit Rider	**Too small to calculate**
Capital Cost/Travel Time Benefit	**$133,300 per hour**
Operating Cost/Travel Time Benefit	**Too small to calculate**
Travel Time Savings	**81 hours per weekday**

Assessment

Overall, this project is rated medium priority. It would attract relatively low numbers of total riders or new transit riders. The capital cost would be relatively small in absolute terms, such that even with limited ridership, the cost per new rider still ranks high among commuter rail expansion projects. Because of the relatively small saving in VMT for each new transit user, cost-effectiveness of air quality improvements would be only moderate. The project would rate low in economic and land-use impacts as it would not serve an area with significant existing or planned development. It would not serve any environmental justice target areas. Its main benefit would be in improving inter-connectivity, as it would provide a new connection between a commuter rail line and the Green Line. Because of the distance separating the two lines, this connection would be only fair.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Economic/ Land Use Impacts	Environ. Justice
New Station	❍	❍	●	◗	◗	❍	❍


Restored Ferry
Long Wharf
Long Wharf to Charlestown Navy Yard
Lovejoy Wharf to Charlestown Navy Yard
Lovejoy Wharf to World Trade Center/Fan Pier
Sumner Tunnel
Callahan Tunnel
Blue Line
MAVERICK
AQUARIUM
STATE*
SOUTH STATION
Old Ironsides (U.S.S. Constitution)
U.S.S. Constitution Museum
Old North Church
Commercial Wharf
Columbus Park
Marriott Hotel
Central Wharf
Harbor Towers
Rowes Wharf
Boston Harbor Hotel
Fan Pier
John J. Moakley Court House
Children's Museum
Commonwealth Pier World Trade Center
Pier 4
Faneuil Hall Marketplace
Post Office Square
Hotel Meridien
Central Square
Intercity bus terminal & Amtrak
Express bus points west via Masspike

D RESTORE EAST BOSTON FERRY

Description

This project would reinstate ferry service between East Boston and Long Wharf or Rowes Wharf on the downtown Boston waterfront. A similar route was run most recently from 1995 to 1997, but was discontinued because of low ridership. Previous ferry service from East Boston had ended in 1952. The project analyzed for the PMT would use an East Boston terminal closer to new development than that of the 1990s service.

Capital Features

This route would require acquisition of two small low-speed commuter ferries, and construction of a new terminal in East Boston.

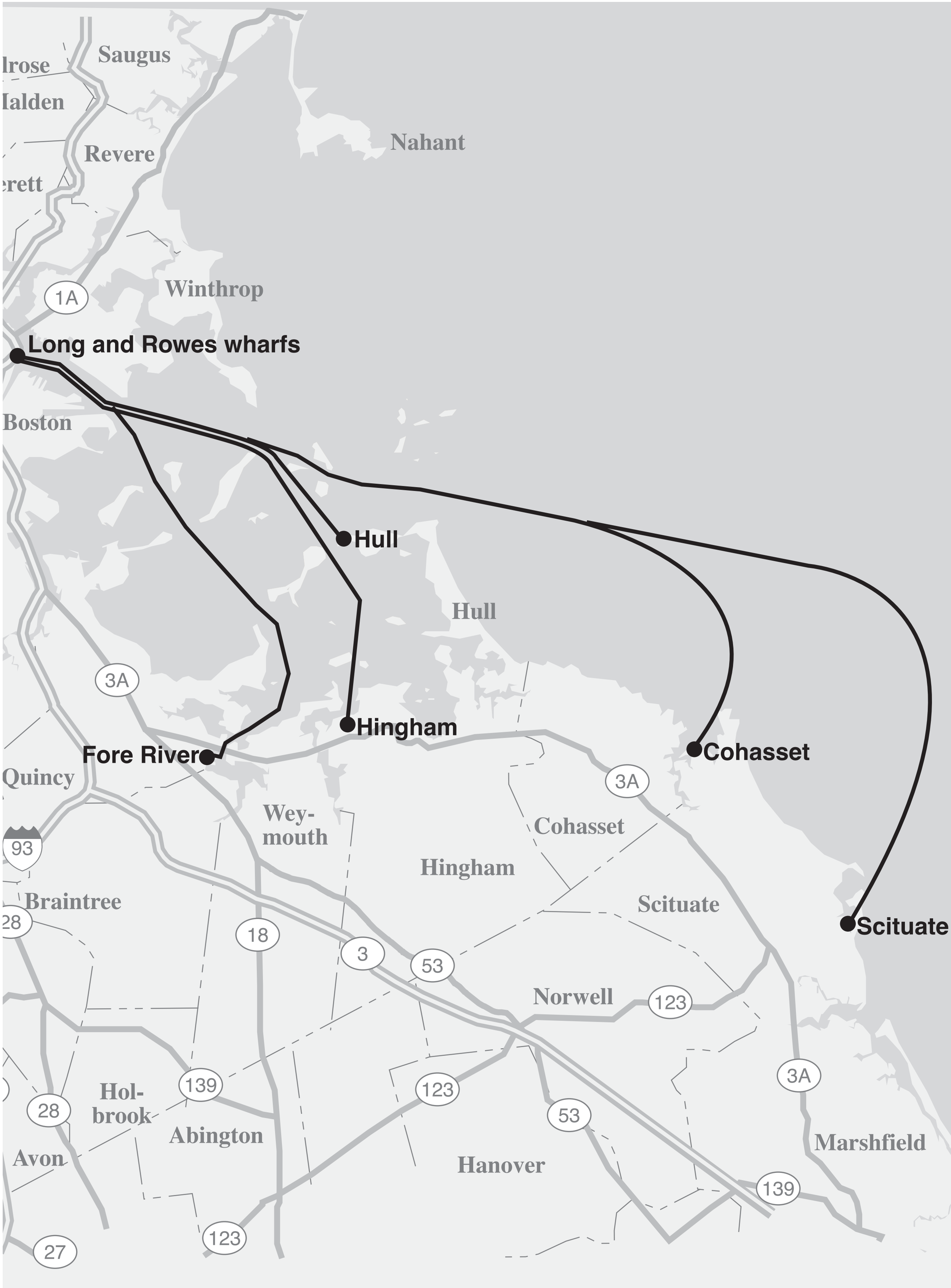
Capital Cost	**$3.5 million (CTPS estimate)**
Operating Cost	**$2,500 per day**
Daily Ridership Increase on Mode	**290**
Net Increase in Daily Transit Ridership	**70**
Capital Cost per New transit Rider	**$50,000**
Operating Cost per Wkday/New transit Rider	**$35.20**
Capital Cost/Travel Time Benefit	**$1,200,000 per hour**
Operating Cost/Travel Time Benefit	**$854.00 per hour**
Travel Time Savings	**3 hours per weekday**

Assessment

This project would provide a new transit alternative for travel from homes in East Boston to work locations in much of the Financial/Retail and Waterfront districts. It would attract few riders that would not otherwise use some form of transit. In absolute terms, the capital and operating costs would be the lowest among all water transportation projects examined for the PMT. Relative to new transit ridership, this project would have the lowest operating cost. It would also have the lowest capital cost per new transit rider if the South Shore projects are considered as a group, and the second-lowest if they are considered individually. However, the costs per unit travel time benefit rank very low. This would be the only one of the water transportation projects that would provide direct service to an environmental justice target community. The overall rating of this project is medium priority.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Economic/ Land Use Impacts	Environ. Justice
Line Extension/ New Line	❍	❍	◗	❍	❍	●	●

MAP 5C-36 IMPROVED FERRY SERVICE FROM SOUTH SHORE COMMUNITIES TO BOSTON



D IMPROVED FERRY SERVICE FROM SOUTH SHORE COMMUNITIES TO BOSTON

Description

This project would include several elements that could be implemented individually or together. The full project would increase service frequency on the existing Hingham and Quincy/Hull commuter boat routes and establish new routes to Boston from Cohasset and Scituate.

Capital Features

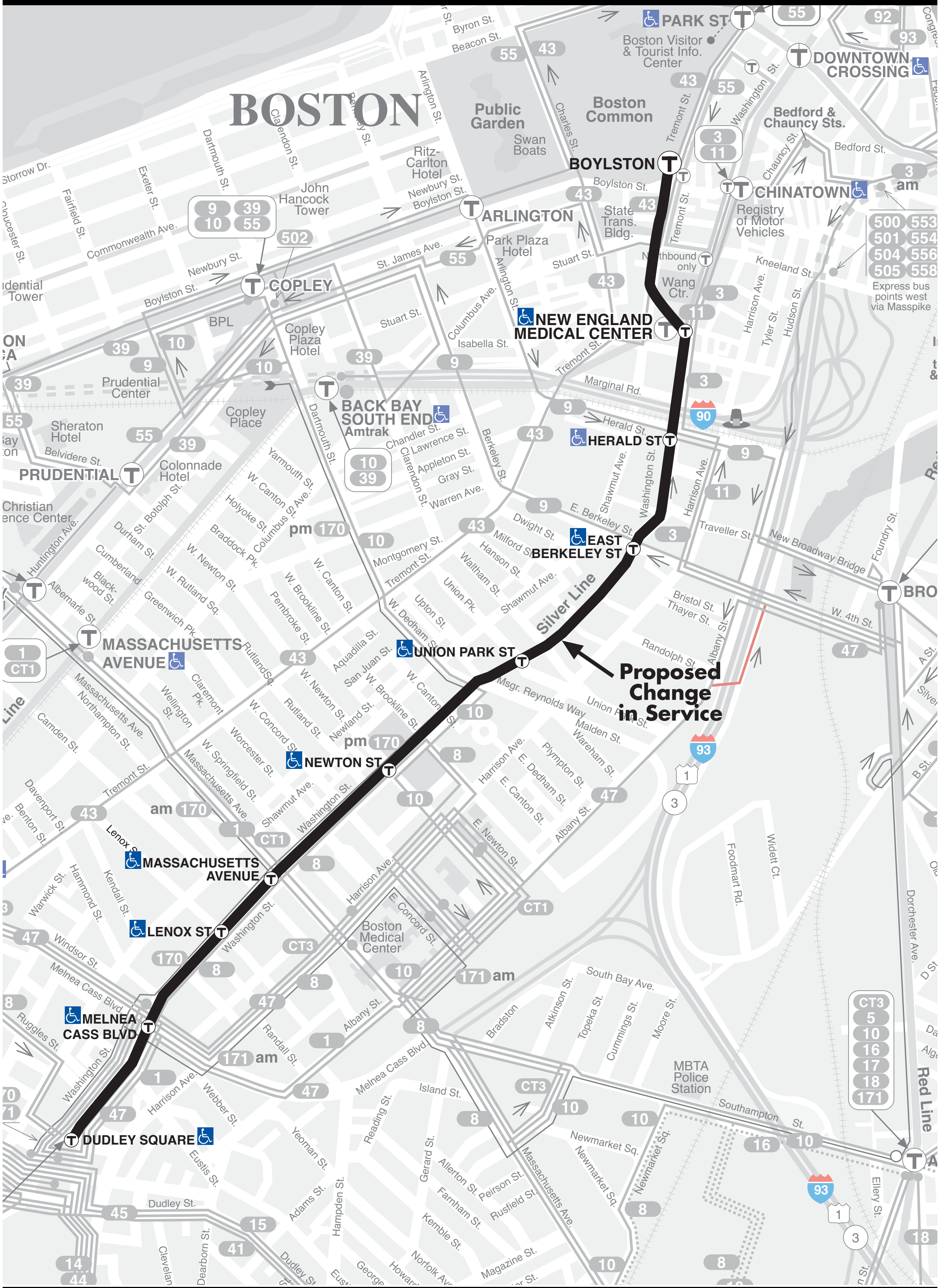
The full alternative would require acquisition of 13 medium-size high-speed commuter boats. Of these, seven would be used to replace slower boats on the Hingham route and increase the frequency of peak service. Each of the other routes would need two new boats. New terminals with parking would be required at Scituate and Cohasset, and some parking expansion at Hingham and Hull would be needed.

Capital Cost	**$39.7 million (CTPS estimate)**
Operating Cost	**$66,300 per day**
Daily Ridership Increase on Mode	**800**
Net Increase in Daily Transit Ridership	**270**
Capital Cost per New transit Rider	**$146,900**
Operating Cost per Wkday/New transit Rider	**$245.50**
Capital Cost/Travel Time Benefit	**$263,900 per hour**
Operating Cost/Travel Time Benefit	**$441.00 per hour**
Travel Time Savings	**150 hours per weekday**

Assessment

This project would add new transit options for travel to Boston from South Shore points, but would have to compete with other transit alternatives including commuter rail and combinations of bus and rapid transit. For all elements of the project combined, the capital cost per new transit rider would be second-highest and the operating cost per new transit rider highest among all water transportation projects examined for the PMT. When the four elements of this project are considered individually, each of them would have higher operating costs per new transit rider than any of the non-South Shore projects. In term of capital cost per new transit rider, a Scituate route and an enhanced Hingham route would both be more costly than any of the other water transportation projects examined, but an enhanced Quincy/Hull route would be the least costly project. A Cohasset route would have the second-lowest capital cost per new transit rider among the South Shore projects, but the second-highest when compared only with the non-South Shore projects. The existing Hingham, Hull, and Quincy terminals serve state-designated revitalization areas, but Scituate and Cohasset terminals would not. Overall, the South Shore commuter boat projects are rated medium priority.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Economic/ Land Use Impacts	Environ. Justice
Frequency Imp./ New Line	●	◗	◗	❍	❍	❍	◗


BOSTON
Public Garden
Swan Boats
Boston Common
Boston Visitor & Tourist Info. Center
PARK ST
DOWNTOWN CROSSING
BOYLSTON
Bedford & Chauncy Sts.
CHINATOWN
Registry of Motor Vehicles
ARLINGTON
Ritz-Carlton Hotel
John Hancock Tower
Park Plaza Hotel
State Trans. Bldg.
Northbound only
Wang Ctr.
COPLEY
BPL
Copley Plaza Hotel
Prudential Center
Sheraton Hotel
PRUDENTIAL
Colonnade Hotel
Copley Place
BACK BAY SOUTH END
Amtrak
NEW ENGLAND MEDICAL CENTER
HERALD ST
EAST BERKELEY ST
Christian Science Center
Express bus points west via Masspike
MASSACHUSETTS AVENUE
UNION PARK ST
Silver Line
Proposed Change in Service
NEWTON ST
MASSACHUSETTS AVENUE
LENOX ST
Boston Medical Center
MELNEA CASS BLVD
DUDLEY SQUARE
MBTA Police Station
pm 170
am 170
171 am
Marginal Rd.
Washington St.
Tremont St.
Harrison Ave.
Albany St.
Melnea Cass Blvd.
Dudley St.
Southampton St.
South Bay Ave.
Massachusetts Ave.
Columbus Ave.
Boylston St.
Newbury St.
Commonwealth Ave.
St. James Ave.
Stuart St.
Herald St.
E. Berkeley St.
Traveller St.
New Broadway Bridge
W. 4th St.
Dorchester Ave.
Red Line

CONVERT DUDLEY–BOYLSTON SECTION OF SILVER LINE TO LIGHT RAIL

Description

This project would convert the 2.4-mile long Dudley-Boylston section of the Silver Line bus rapid transit service to light rail. Service would be operated as a branch of the Green Line, making use of an abandoned Green Line tunnel segment located under Tremont Street, to access Boylston station. Stops on Washington Street between Herald St. and Dudley would remain the same as the present Silver Line.

Capital Feature

Upgrade abandoned Green Line tunnel for service, construct new portal to tunnel, build new surface light rail line on Washington Street from portal to Dudley, purchase additional vehicles.

Capital Cost	**$373.6 million (CTPS estimate)**
Operating Cost	**$6,100 per weekday**
Daily Ridership Increase on Mode	**34,300**
Net Increase in Daily Transit Ridership	**130**
Capital Cost/New Transit Rider	**$2,873,500**
Operating Cost per Wkday/New Transit Rider	**$46.60**
Capital Cost/Travel Time Benefit	**$642,800 per hour**
Operating Cost/Travel Time Benefit	**$10.40 per hour**
Travel Time Savings	**581 hours per weekday**

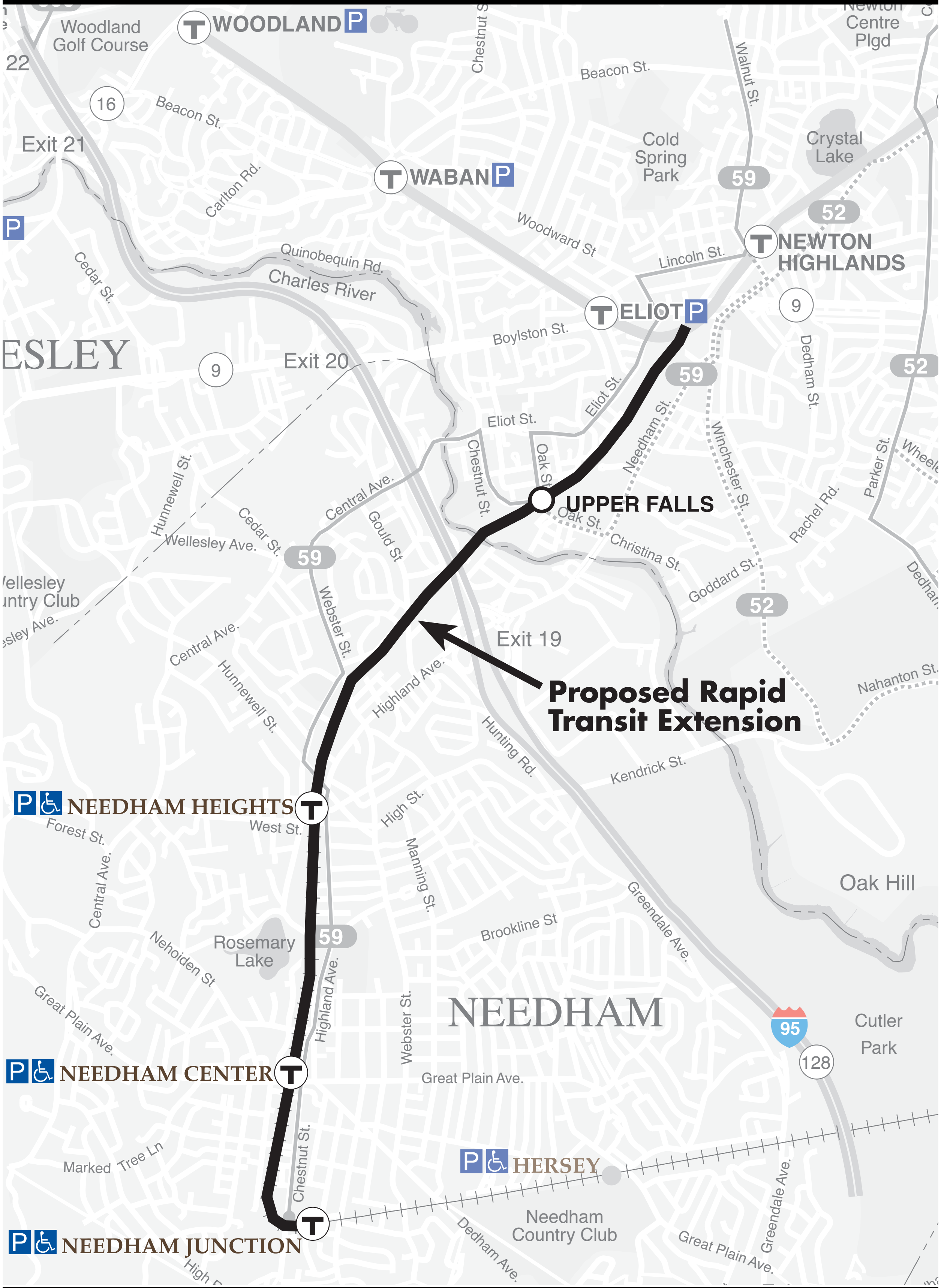
Assessment

This is a low-priority rapid transit expansion project. Service on the Washington Street corridor between Dudley and Downtown Boston is presently provided by Phase 1 of the Silver Line bus rapid transit project. The MBTA proposes a Phase 3 project which would link the present Phase 1 Dudley-Downtown service with Phase 2 South Station-South Boston waterfront service. However, this project proposes that transit service on Washington Street instead be converted to light-rail and operated as a branch of the Green Line to Government Center.

The projected capital costs would be $373.6 million. Additional typical daily operating costs above the present Silver Line service would be $6,100. There would be 34,300 passengers new to the mode with this project. Only 130 would be new transit riders, since the majority of riders would be diverted from Washington Street Silver Line Bus Rapid Transit service. The capital cost per new transit rider would be the highest of any rapid transit project evaluated at $2,873,500. The additional operating cost per new transit rider would be $46.60. If this project is pursued, Phase III of the Silver Line BRT project would be reduced to only include a South Station-Boylston Street segment. Correspondingly, initial engineering plans for a turn around loop and station at Boylston Street would need to be changed.

The impact on air quality would be low, as few new riders would be diverted from automobiles. The project would provide one-seat rides between locations along Washington Street and Government Center. Transfer opportunities with other parts of the Green Line, the Blue Line and the Red Line would be improved. This project would also provide direct service to areas of Roxbury which are environmental justice target neighborhoods.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Economic/ Land Use Impacts	Environ. Justice
Line Extension	❍	❍	❍	❍	◗	●	●


WOODLAND
Woodland Golf Course
WABAN
NEWTON HIGHLANDS
ELIOT
UPPER FALLS
NEEDHAM HEIGHTS
NEEDHAM CENTER
NEEDHAM JUNCTION
HERSEY
Proposed Rapid Transit Extension
Charles River
Cold Spring Park
Crystal Lake
Newton Centre Plgd
Beacon St.
Walnut St.
Woodward St
Lincoln St.
Boylston St.
Quinobequin Rd.
Carlton Rd.
Cedar St.
Exit 21
Exit 20
Exit 19
ESLEY
Eliot St.
Oak St.
Chestnut St.
Needham St.
Winchester St.
Dedham St.
Parker St.
Christina St.
Goddard St.
Rachel Rd.
Central Ave.
Gould St
Hunnewell St.
Wellesley Ave.
Webster St.
Highland Ave.
Hunting Rd.
Kendrick St.
Nahanton St.
Forest St.
West St.
High St.
Manning St.
Rosemary Lake
Nehoiden St
Great Plain Ave.
Brookline St
Greendale Ave.
Oak Hill
NEEDHAM
Cutler Park
Marked Tree Ln
Needham Country Club
Dedham Ave.
59
52
9
16
95
128

❍ NEW GREEN LINE NEEDHAM BRANCH

Description

This project would add a branch to the Green Line, diverging from the D Branch between the Newton Highlands and Eliot stations and following the alignment of a lightly used rail freight line and the outer end of the Needham Commuter rail line to Needham Junction. Commuter rail service to Needham Center and Needham Heights would be discontinued.

Capital Features

This would be a 3.8-mile extension, including one new station in Newton, a new facility for transfer between commuter rail and Green Line at Needham Junction and substitution of Green Line service for commuter rail at two other stations in Needham.

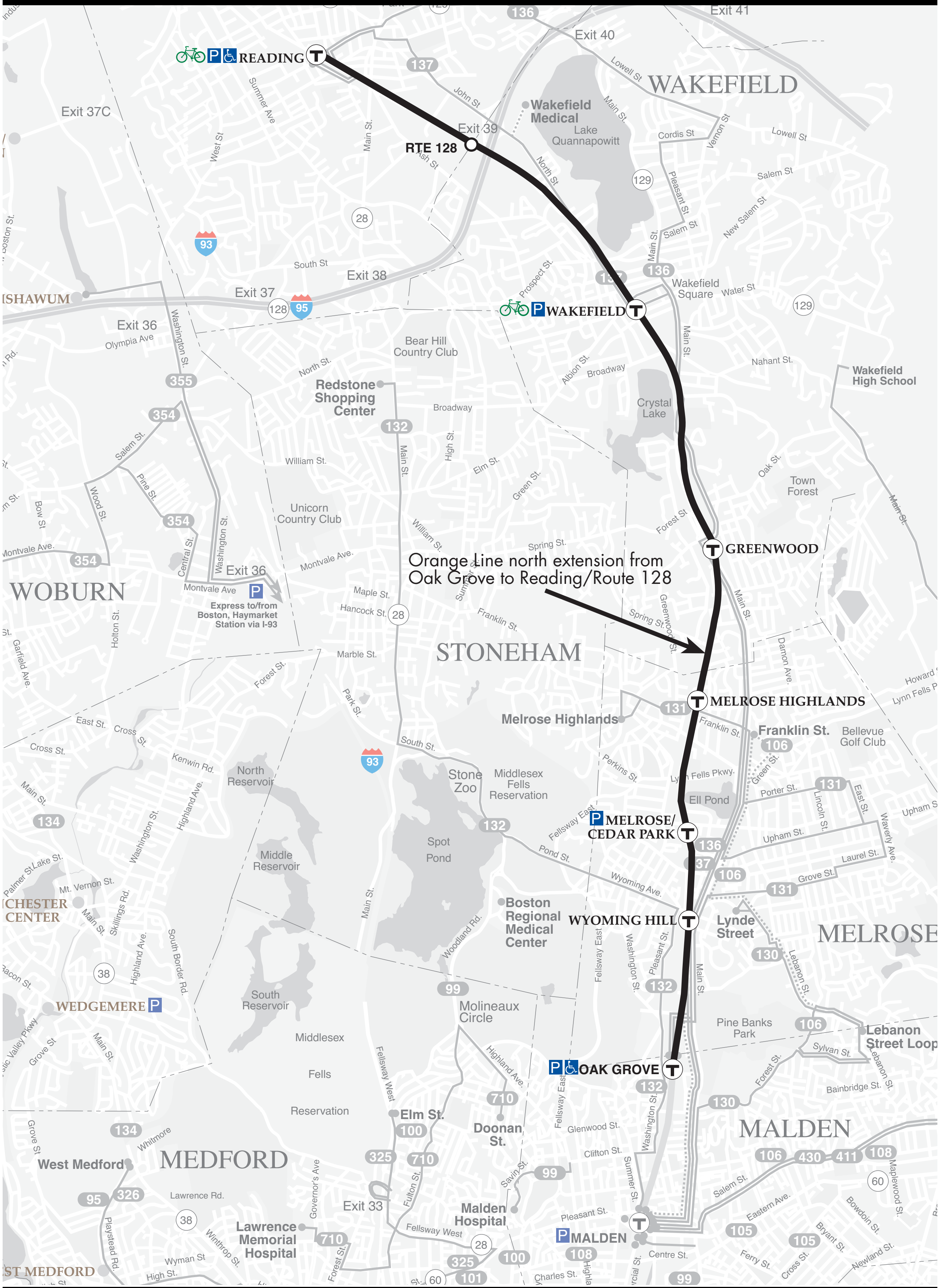
Capital Cost	**$123.9 million (CTPS estimate)**
Operating Cost	**$16,600 per weekday**
Daily Ridership Increase on Mode	**3,400**
Net Increase in Daily Transit Ridership	**500**
Capital Cost per New Transit Rider	**$247,800**
Operating Cost per Wkday/New Transit Rider	**$33.30**
Capital Cost/Travel Time Benefit	**$2,655,000 per hour**
Operating Cost/Travel Time Benefit	**$356.30 per hour**
Travel Time Savings	**47 hours per weekday**

Assessment

Overall, this project is rated low priority. It would replace the outer end of an existing commuter rail line with a rapid transit extension, providing more frequent service and direct service to a greater number of destinations. It would also provide rail transit service to a densely populated section of Newton that is currently served only by local buses. It would not serve any environmental justice target communities. In absolute terms, this would be one of the less costly rapid transit extensions examined, but it would be among the more costly projects relative to the amount of new ridership attracted. This project would be compatible with a commuter rail extension from Needham Junction to Millis. It would add to the complexity of Green Line operations, as service would need to be coordinated with that of the D Branch above ground and with B, C, and E branch service in the Central Subway. It might necessitate some reduction in the amount of D branch service provided at stations west of Newton Highlands.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Economic/ Land Use Impacts	Environ. Justice
Line Extension	❍	❍	❍	❍	◗	❍	❍

MAP 5C-39 ORANGE LINE NORTH EXT. FROM OAK GROVE TO READING/RT 128



ORANGE LINE NORTH EXTENSION FROM OAK GROVE TO READING/RT 128

Description

This project would extend Orange Line service from Oak Grove Station to Reading via the Haverhill/Reading commuter rail line right-of-way. Commuter rail service on this line would be discontinued between Boston and North Wilmington. Service to points further north would be re-routed via Wilmington and the Lowell Line.

Capital Features

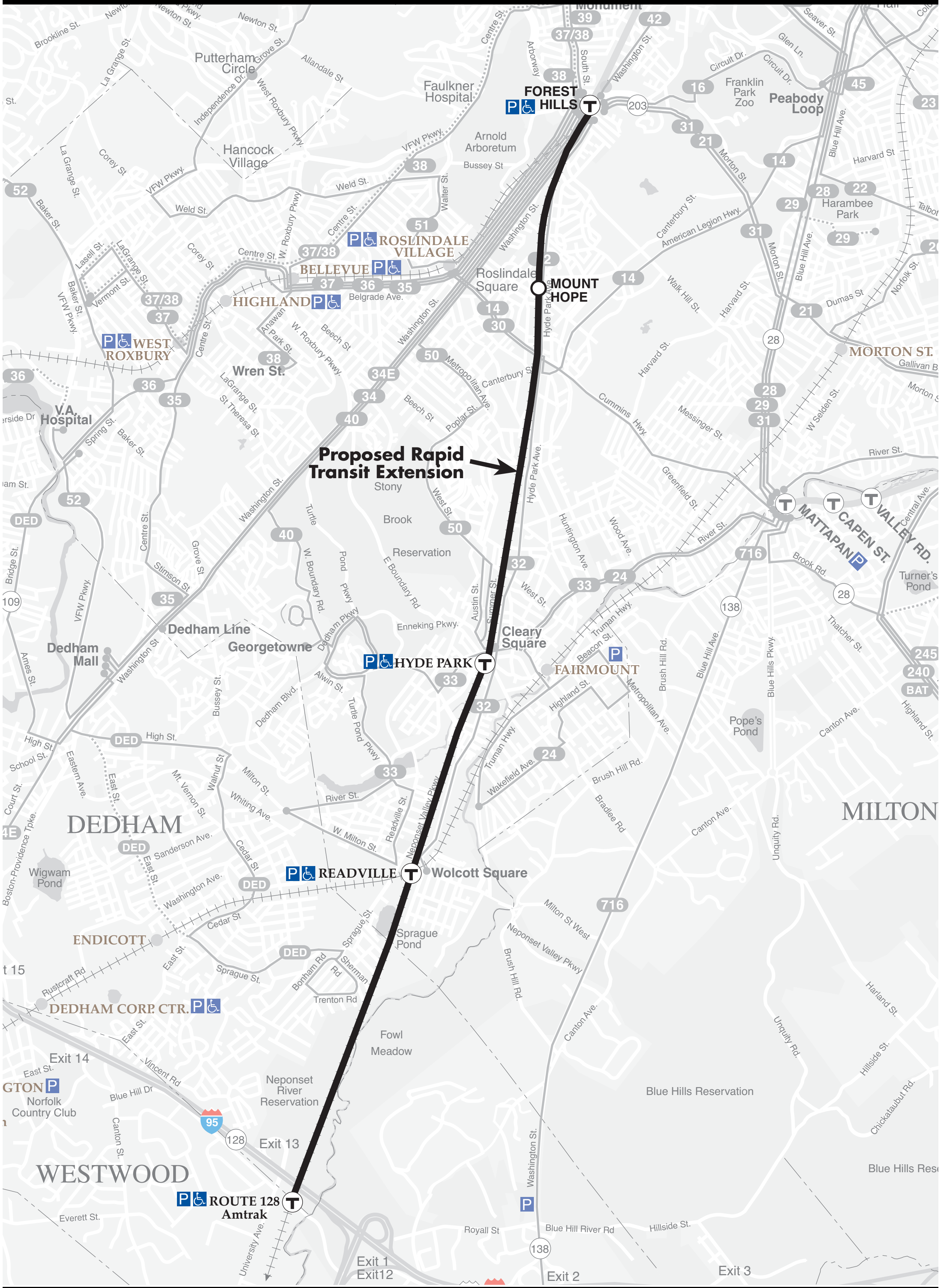
This would be a 6.5-mile extension, including six new stations, in Melrose, Wakefield, and Reading and elimination of 12 present grade crossings by lowering of the tracks and of one by building a new highway overpass.

Capital Cost	**$487.8 million (CTPS estimate)**
Operating Cost	**$109,500 per weekday**
Daily Ridership Increase on Mode	**9,400**
Net Increase in Daily Transit Ridership	**5,400**
Capital Cost per New Transit Rider	**$90,500**
Operating Cost per Wkday/New Transit Rider	**$20.30**
Capital Cost/Travel Time Benefit	**$413,800 per hour**
Operating Cost/Travel Time Benefit	**$92.90 per hour**
Travel Time Savings	**1,179 hours per weekday**

Assessment

Overall, this project is rated low priority. It would replace an existing commuter rail line with a rapid transit extension, providing more frequent service and eliminating a transfer for passengers with destinations on the Orange Line beyond walking distance of North Station. In absolute terms, the capital cost would fall in the upper mid-range of all rapid transit extensions examined for the PMT. It would, however, also be in the upper mid-range in terms of air quality improvement. It would not serve any environmental justice target communities.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Economic/ Land Use Impacts	Environ. Justice
Line Extension	◗	❍	❍	◗	❍	❍	❍


Proposed Rapid Transit Extension
FOREST HILLS
MOUNT HOPE
HYDE PARK
READVILLE
ROUTE 128 Amtrak
ROSLINDALE VILLAGE
BELLEVUE
HIGHLAND
WEST ROXBURY
FAIRMOUNT
MORTON ST.
MATTAPAN
CAPEN ST.
VALLEY RD.
ENDICOTT
DEDHAM CORP. CTR.
DEDHAM
MILTON
WESTWOOD
Roslindale Square
Cleary Square
Wolcott Square
Stony Brook Reservation
Blue Hills Reservation
Neponset River Reservation
Fowl Meadow
Franklin Park Zoo
Arnold Arboretum
Dedham Mall
V.A. Hospital
Faulkner Hospital
Exit 13

ORANGE LINE SOUTH EXTENSION FROM FOREST HILLS TO RT 128

Description

This project would extend Orange Line service from Forest Hills Station in Boston to Route 128 via the Providence commuter rail line right-of-way. Commuter and intercity rail passenger service on this line would also continue.

Capital Features

This would be a 6.4-mile extension, including three stations in Boston neighborhoods and terminating at the existing Route 128 park-and-ride station. This segment of the rail line is already fully grade-separated. Some reconfiguration of the tracks would be needed to allow for two Orange Line tracks in addition to railroad tracks.

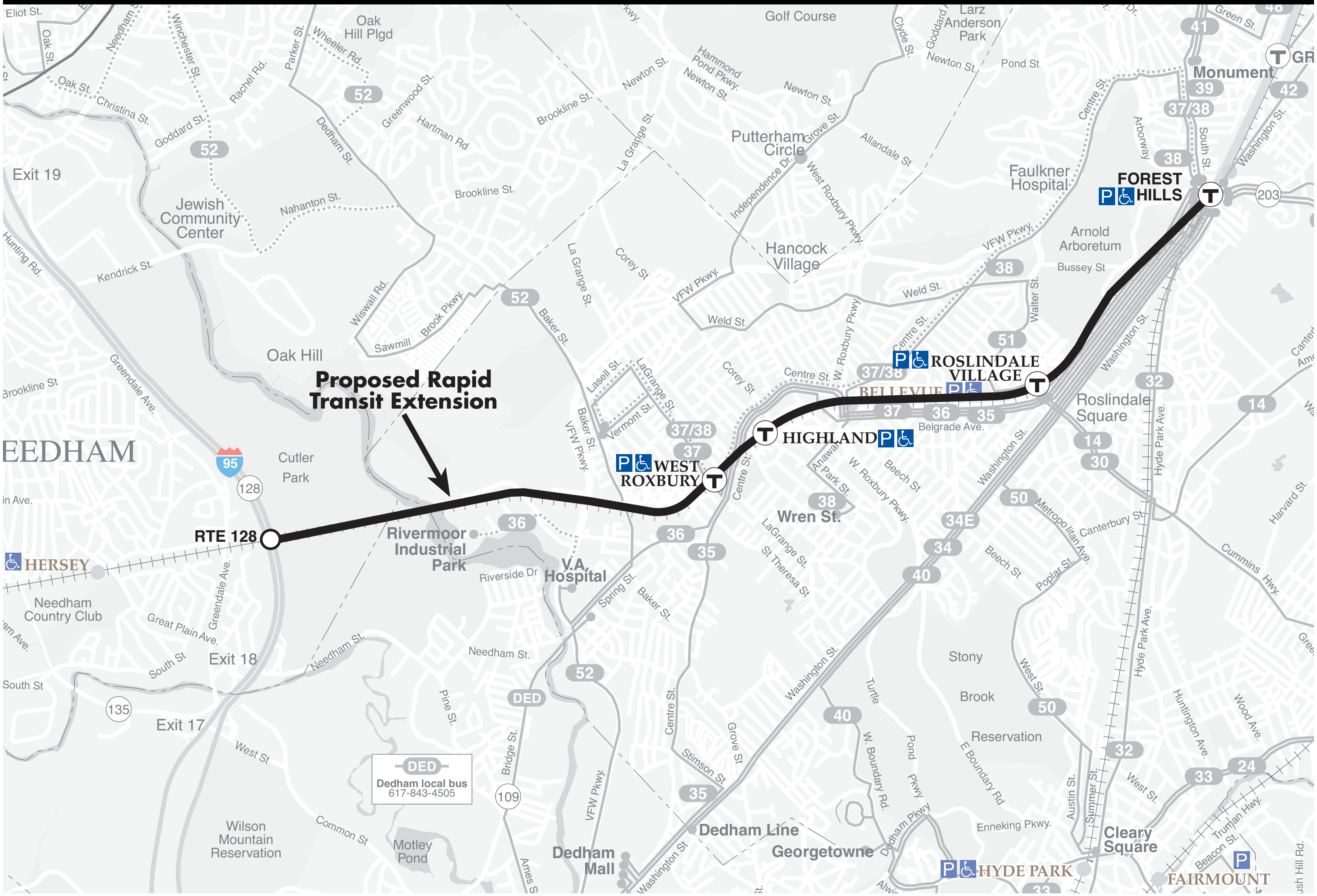
Capital Cost	**$342.8 million (CTPS estimate)**
Operating Cost	**$94,900 per weekday**
Daily Ridership Increase on Mode	**4,700**
Net Increase in Daily Transit Ridership	**2,000**
Capital Cost per New Transit Rider	**$172,300**
Operating Cost per Wkday/New Transit Rider	**$47.70**
Capital Cost/Travel Time Benefit	**$677,100 per hour**
Operating Cost/Travel Time Benefit	**$187.40 per hour**
Travel Time Savings	**506 hours per weekday**

Assessment

Overall, this project is rated low priority. It would supplement an existing commuter rail line with a rapid transit extension, providing more frequent and direct service to a greater number of destinations. This would be one of the more costly extensions examined in absolute terms and in capital and operating cost per new transit rider. It would be moderately effective in terms of air quality improvement and in cost relative to this improvement. Wetlands along the alignment near Route 128 could prevent the grade from being widened sufficiently to add Orange Line tracks. The existing Route 128 station layout does not provide for any additional tracks or platforms.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Economic/ Land Use Impacts	Environ. Justice
Line Extension	❍	❍	❍	◗	◗	◗	◗

MAP 5C–41 ORANGE LINE SOUTH EXTENSION FROM FOREST HILLS TO WEST ROXBURY/NEEDHAM



ORANGE LINE SOUTH EXTENSION FROM FOREST HILLS TO NEEDHAM

Description

This project would extend Orange Line service from Forest Hills Station in Boston to Route 128 via the Needham commuter rail line right-of-way. Commuter rail service on this line would be discontinued.

Capital Features

This would be a 5.1-mile extension, including two or three stations in West Roxbury, and a major park-and-ride facility at the outer terminal. This segment of the rail line is already fully grade-separated, but is mostly single-tracked. A second track would be needed for Orange Line service.

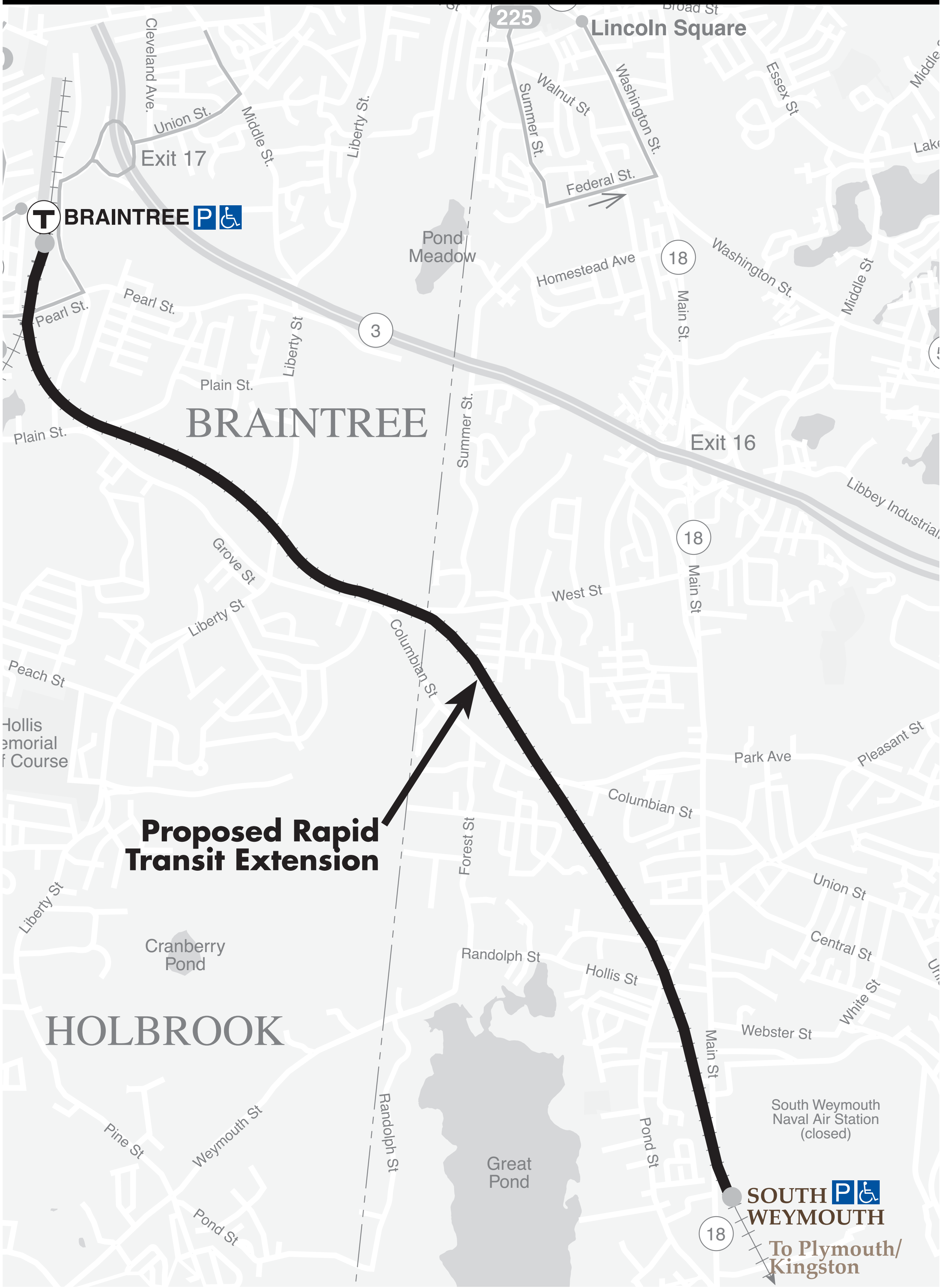
Capital Cost	**$316.2 million (Based on 1994 PMT, adjusted to 2003)**
Operating Cost	**$79,900 per weekday**
Daily Ridership Increase on Mode	**11,300**
Net Increase in Daily Transit Ridership	**600**
Capital Cost per New Transit Rider	**$514,200**
Operating Cost per Wkday/New Transit Rider	**$129.90**
Capital Cost/Travel Time Benefit	**$2,804,700 per hour**
Operating Cost/Travel Time Benefit	**$708.70 per hour**
Travel Time Savings	**113 hours per weekday**

Assessment

Overall, this project is rated low priority. It would replace an existing commuter rail line with a rapid transit extension, providing more frequent and direct service to a greater number of destinations. This would be one of the more costly extensions examined in absolute terms and in capital and operating cost per new transit rider. It would be relatively ineffective in terms of air quality improvement and in cost to achieve to this improvement. The three outer stations on the present commuter rail line would no longer have rail transit service, and a commuter rail extension to Millis via Needham would no longer be feasible.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Economic/ Land Use Impacts	Environ. Justice
Line Extension	❍	❍	❍	❍	❍	❍	◗

MAP 5C-42 RED LINE EXTENSION TO WEYMOUTH



RED LINE EXTENSION TO WEYMOUTH

Description

This project would extend Red Line service from Braintree Station to South Weymouth, sharing the right-of-way of the Plymouth/Kingston commuter rail line.

Capital Features

This would be a 4.3-mile extension, including one new station with a major park-and ride facility in Weymouth. Elimination of four grade crossings of roads and a grade separated crossing of the Red Line with the Old Colony commuter rail lines would be required.

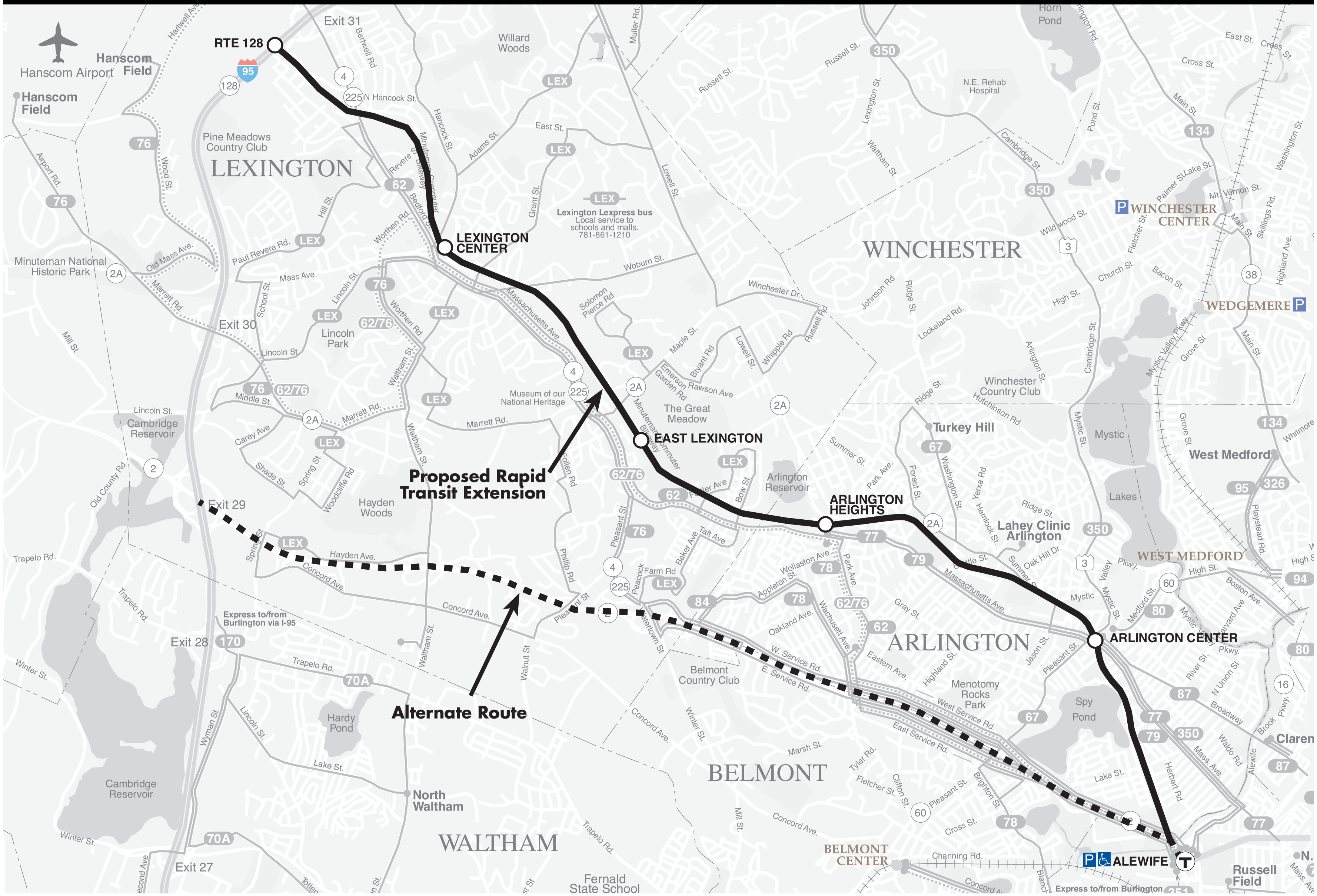
Capital Cost	**$304.2 million (CTPS estimate)**
Operating Cost	**$52,000 per weekday**
Daily Ridership Increase on Mode	**6,700**
Net Increase in Daily Transit Ridership	**2,900**
Capital Cost per New Transit Rider	**$104,900**
Operating Cost per Wkday/New Transit Rider	**$17.90**
Capital Cost/Travel Time Benefit	**$1,000,000 per hour**
Operating Cost/Travel Time Benefit	**$171.00 per hour**
Travel Time Savings	**304 hours per weekday**

Assessment

Overall, this project is rated low priority. It would bring Red Line service closer to the sources of many of the trips that are currently made via Braintree or Quincy Adams, and would help prevent overcrowding on the inner end of the Plymouth/Kingston commuter rail line. However, it would not result in transit service being provided to an area that does not currently have such service. Capital cost would be in the mid-range among rapid transit extension projects analyzed. It would also be in the mid-range of projects in terms of capital cost relative to new transit riders and to air quality improvements, even though the overall cost-effectiveness rating is low. It does, however receive a high rating for economic and land use impacts. The Weymouth station would be in a state-designated revitalization area and would aid in the redevelopment of a brownfield site.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Economic/Land Use Impacts	Environ. Justice
Line Extension	◗	❍	❍	◗	❍	●	❍

MAP 5C-43 RED LINE NORTHWEST EXTENSION FROM ALEWIFE TO RT 128



RED LINE NORTHWEST EXTENSION FROM ALEWIFE TO RT 128

Description

This project would extend Red Line service from Alewife Station in Cambridge to Route 128 via the former Lexington Branch railroad alignment (now the route of the Minuteman Bikeway).

Capital Features

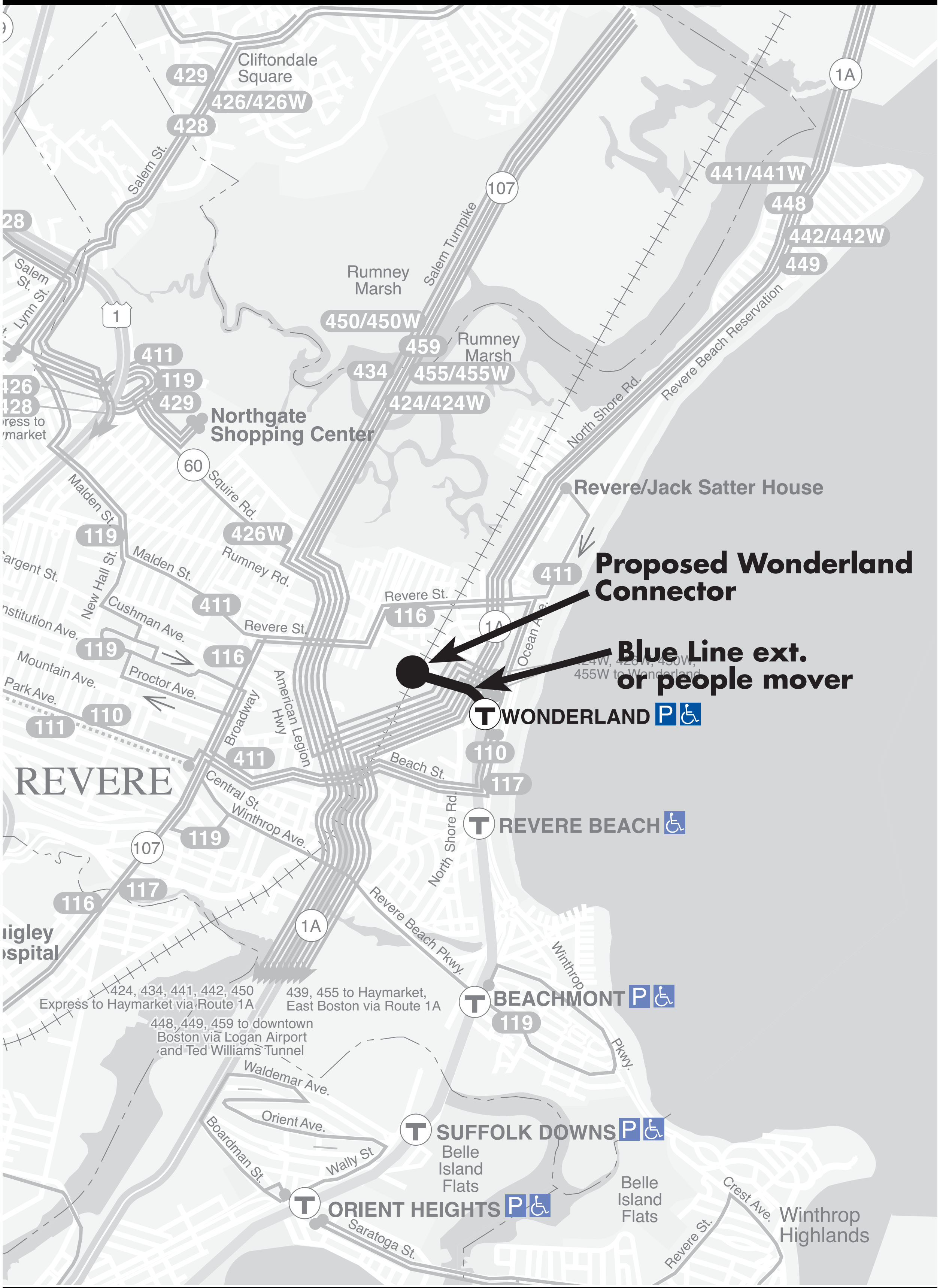
This would be an 8.3-mile extension, including five new stations, in Arlington and Lexington, with a major park-and-ride facility at the outer terminal. Because of numerous grade-crossings, the tracks would have to be placed in cuts or subways for much of the way.

Capital Cost	**$749.3 million (CTPS estimate)**
Operating Cost	**$121,800 per weekday**
Daily Ridership Increase on Mode	**6,700**
Net Increase in Daily Transit Ridership	**1,700**
Capital Cost per New Transit Rider	**$440,800**
Operating Cost per Wkday/New Transit Rider	**$71.70**
Capital Cost/Travel Time Benefit	**$421,700 per hour**
Operating Cost/Travel Time Benefit	**$68.60 per hour**
Travel Time Savings	**1,777 hours per weekday**

Assessment

Overall, this project is rated low priority. It would provide rail transit service to sections of Arlington and Lexington that are currently served by bus routes connecting with the Red Line. In absolute terms, it would be among the most costly of all rapid transit extensions examined for the PMT. It would also be in the lower range of projects in terms of new transit ridership attracted, and air quality benefits. Operating cost per new transit rider would be among the highest of any extension. Segments of the popular Minuteman Bikeway would have to be shut down during construction, and some might be lost permanently. The area served by this project has relatively sparse commercial or mixed-use development. The route would not provide direct service to any environmental justice target communities.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Economic/ Land Use Impacts	Environ. Justice
Line Extension	❍	❍	❍	◗	◗	❍	❍


Cliftondale Square
429
426/426W
428
Salem St.
107
1A
441/441W
448
442/442W
449
Rumney Marsh
Salem Turnpike
1
450/450W
459
Rumney Marsh
411
119
429
434
455/455W
424/424W
Northgate Shopping Center
North Shore Rd.
Revere Beach Reservation
60
Squire Rd.
Malden St.
Revere/Jack Satter House
119
426W
Rumney Rd.
Malden St.
Proposed Wonderland Connector
411
New Hall St.
Cushman Ave.
411
Revere St.
116
Revere St.
Blue Line ext. or people mover
119
116
Mountain Ave.
Proctor Ave.
American Legion Hwy
Ocean Ave.
Park Ave.
Broadway
WONDERLAND
110
111
411
Beach St.
110
REVERE
Central St.
117
Winthrop Ave.
North Shore Rd
REVERE BEACH
119
107
117
116
Revere Beach Pkwy.
1A
Winthrop Pkwy.
424, 434, 441, 442, 450 Express to Haymarket via Route 1A
439, 455 to Haymarket, East Boston via Route 1A
BEACHMONT
119
448, 449, 459 to downtown Boston via Logan Airport and Ted Williams Tunnel
Waldemar Ave.
Orient Ave.
SUFFOLK DOWNS
Belle Island Flats
Boardman St.
Wally St
Belle Island Flats
Crest Ave.
Winthrop Highlands
ORIENT HEIGHTS
Saratoga St.
Revere St.

❍ WONDERLAND CONNECTOR

Description

This project calls for the construction of a station along the Newburyport/Rockport commuter rail line near Wonderland Station in Revere. Various alternatives exist to provide a direct physical link between the Blue Line and commuter rail service including a realignment of the Blue Line and an automated peoplemover system. The MBTA is currently evaluating these options as part of its Draft Environmental Impact Statement (DEIS) for the Revere to Salem corridor.

Capital Features

Construction of an inter-modal passenger facility.

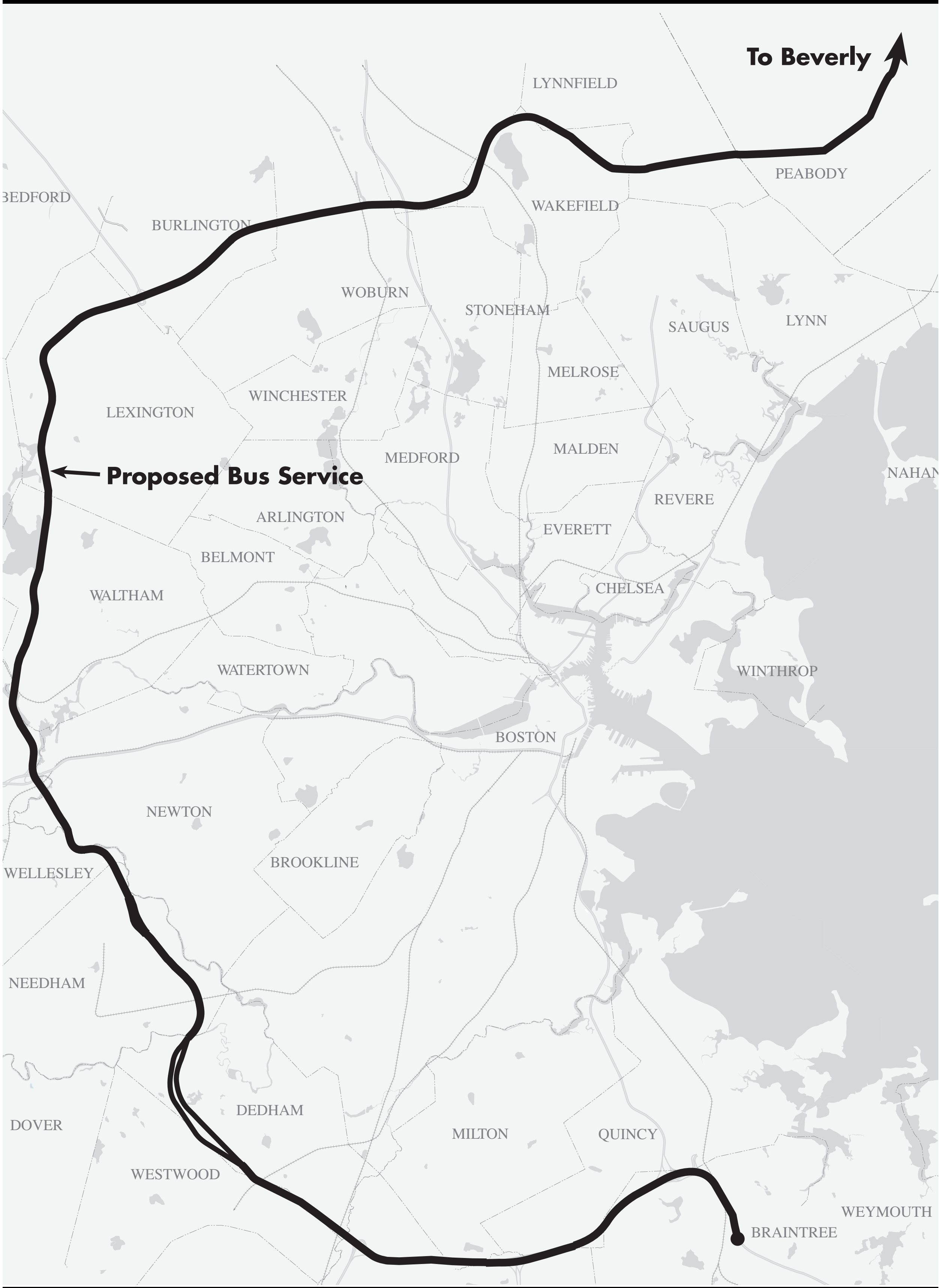
Capital Cost	**$70.0 million (Based on 1997 Wonderland Feasibility Study, adjusted to 2003)**
Operating Cost	**none**
Daily Ridership Increase on Mode	**900**
Net Increase in Daily Transit Ridership	**500**
Capital Cost/New Transit Rider	**$140,100**
Operating Cost per Wkday/New Transit Rider	**none**
Capital Cost/Travel Time Benefit	**$604,600 per hour**
Operating Cost/Travel Time Benefit	**NA**
Travel Time Savings	**116 hours per weekday**

Assessment

This is a low priority rapid transit expansion project based on an analysis of the peoplemover option. Other alternatives currently under review in the DEIS do not appear to match the community's plans or the MBTA's operational needs. The capital cost for this project would be $70 million. There would be no additional typical day Blue Line operating costs. This project would attract 900 riders to the rapid transit mode, of which 500 would be new transit riders. Capital cost per new transit rider would be $140,100. There would be minimal added costs to operate the connector once it is constructed. Access to Logan Airport would be improved via connections between the Blue Line and Commuter Rail. While this major transportation facility would be located in Revere, the city would receive little direct transportation benefit from the project. Thus the project receives a low environmental justice rating. The expansion of a transit facility in Wonderland would be compatible with regional plans and designated revitalization areas. The travel time benefit for this project would primarily be for commuter rail riders bound for destinations in the financial district which have close access to Aquarium and State Street stations on the Blue Line.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Economic/ Land Use Impacts	Environ. Justice
New Station	❍	❍	◗	◗	❍	●	❍

MAP 5C-45 ROUTE 128 CIRCUMFERENTIAL BUS SERVICE



ROUTE 128 CIRCUMFERENTIAL BUS SERVICE

Description

This proposal calls for providing bus service along Route 128 which would operate every 30 minutes in the peak and every 60 minutes in the off-peak. Service would operate between Beverly and Braintree, with stops provided at major interchanges and at connecting transit facilities. Employer feeder shuttles would link with the circumferential buses. Connections would be made with commuter rail, the Braintree branch of the Red Line, the Riverside branch of the Green Line, and several local bus routes. A general purpose travel lane in each direction would be converted to an HOV lane to improve bus travel times.

Capital Features

Purchase of additional buses, conversion of a general traffic lane to an HOV lane in both directions.

Capital Cost	**$29.0 million (CTPS estimate)**
Operating Cost	**$22,400 per weekday**
Daily Ridership Increase on Mode	**4,200**
Net Increase in Daily Transit Ridership	**4,500**
Capital Cost/New Transit Rider	**$6,900**
Operating Cost per Wkday/New Transit Rider	**$5.00**
Capital Cost/Travel Time Benefit	**No benefit**
Operating Cost/Travel Time Benefit	**No benefit**
Travel Time Savings	**There are no travel time benefits**

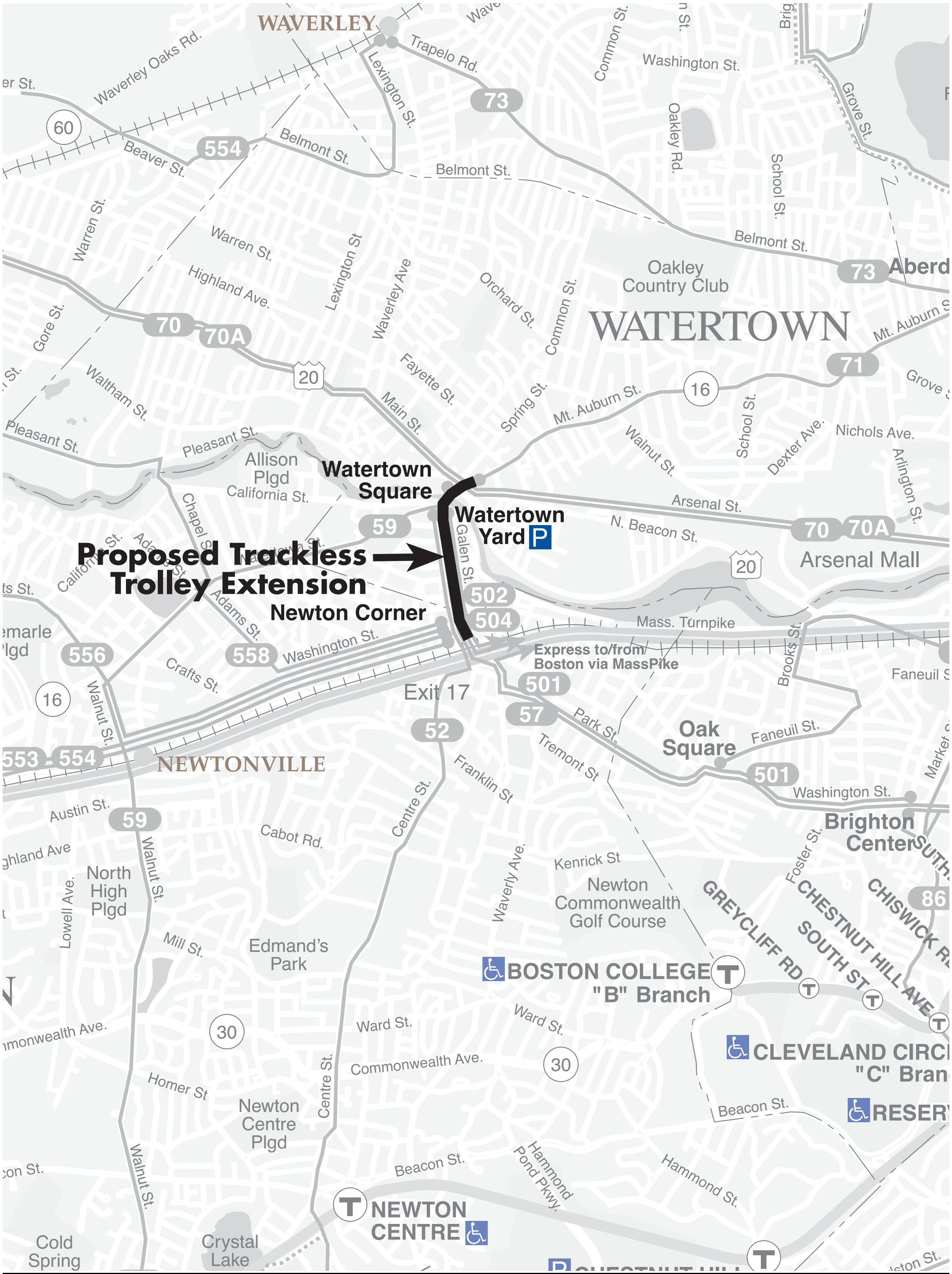
Assessment

This is a low-priority bus expansion project. The capital costs for this project would be $29 million and the typical daily operating costs would be $22,400. This project would attract 4,200 riders to the mode, of which 4,500 would be new to transit. The capital cost per new transit rider would be $6,900 while the operating cost per new rider would be $5.00. The operating cost per new rider only receives a medium score compared to other projects in the same category and cost-effectiveness overall is rated low. Utilization receives a medium score, as the project would draw new riders from automobiles and increase transit mode share, but the travel time savings for this project are very poor. Mobility would be improved, as access would be provided to employment areas now without transit service. Direct connections would be provided to radial transit routes. Suburb to suburb travel would be direct and require shorter trips.

The service would not provide direct service to environmental justice target comminutes, but connections to the existing transit network would provide access to employment areas now only reachable via automobile. Service quality would be low however, as travel times would be long and reliability would be vulnerable to traffic congestion. Multiple transfers would still be required, as all riders traveling to suburban workplaces would need to transfer to circulator shuttles provided by employers to reach their final destination. The conversion of general purpose highway lanes to HOV lanes to benefit this project would result in a dramatic increase in congestion and travel times overall.

Type of Project	Utilization	Mobility	Cost–Effectiveness	Air Quality	Service Quality	Environ. Justice
Line Extension/ New Line	◗	●	❍	❍	❍	❍

MAP 5C-46 EXTEND TRACKLESS TROLLEY #71 FROM WATERTOWN TO NEWTON CORNER



EXTEND TRACKLESS TROLLEY #71 FROM WATERTOWN TO NEWTON CORNER

Description

This proposal calls for extending Route 71 Watertown-Harvard trackless trolley service between Watertown Square and Newton Corner. This would provide direct one-seat service between Newton Corner and locations served by Route 71 in Watertown and Cambridge. It would also provide a direct connection between Route 71 and bus routes 553, 554, 556, and 558 at Newton Corner. New trackless trolley wire would be extended over 0.5 miles of Galen Street in Watertown and the trackless trolley fleet would expand by one vehicle to provide the additional service.

Capital Features

Installation of 0.5 route miles of new trackless trolley overhead contact system, purchase of one additional vehicle.

Capital Cost	**$1.5 million (CTPS estimate)**
Operating Cost	**$1,400 per weekday**
Daily Ridership Increase on Mode	**800**
Net Increase in Daily Transit Ridership	**600**
Capital Cost/New Transit Rider	**$2,500**
Operating Cost per Wkday/New Transit Rider	**$2.40**
Capital Cost/Travel Time Benefit	**$23,200 per hour**
Operating Cost/Travel Time Benefit	**Travel time benefits not yet calculated**
Travel Time Savings	**65 hours per weekday**

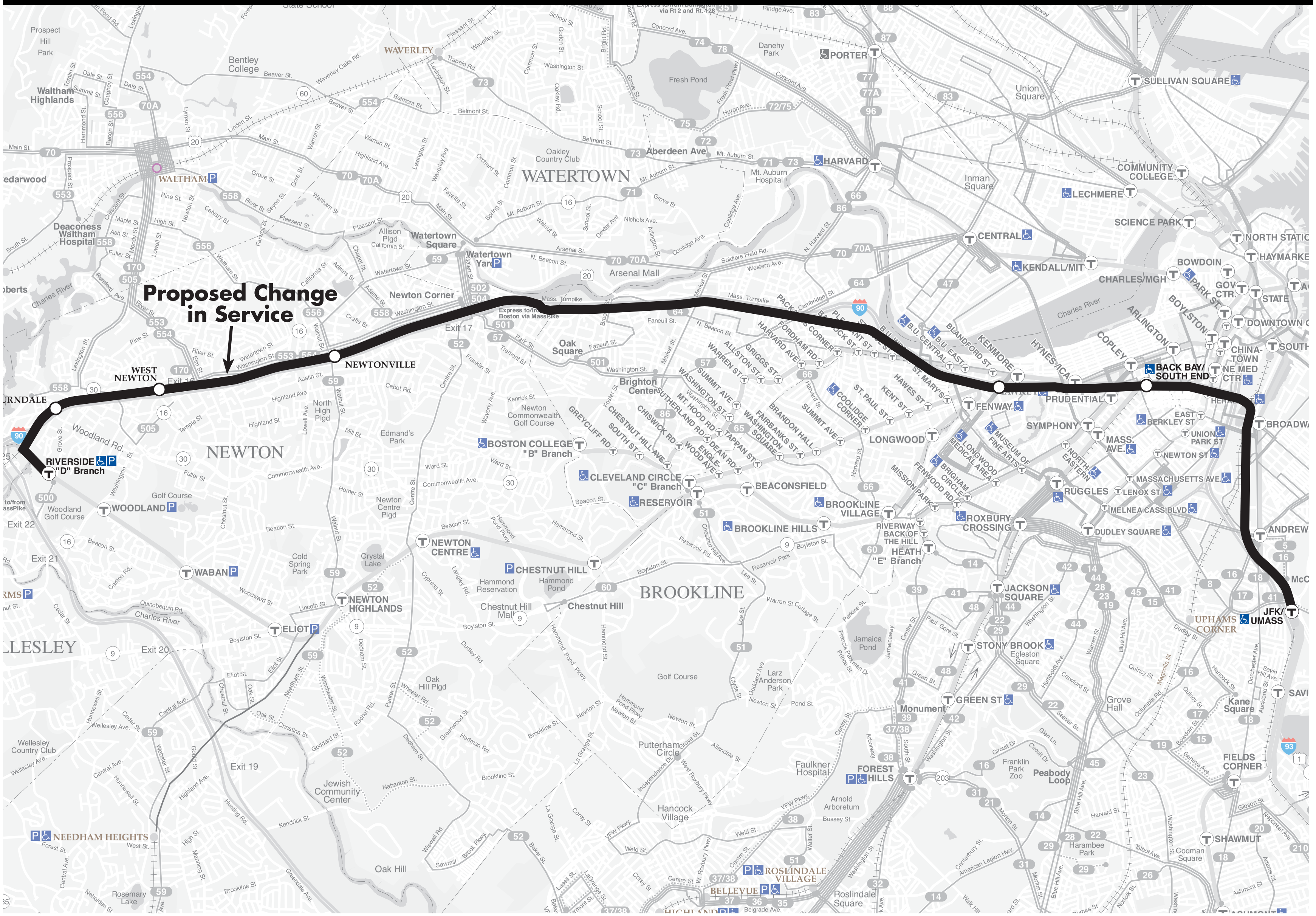
Assessment:

This is a low-priority bus expansion project. The capital costs for this project would be $1.5 million and the typical daily operating costs would be $1,400. This project would attract 800 riders to the mode, of which 600 would be new transit riders. The capital cost per new transit rider would be $2,500 and the operating cost would be $2.40 per new transit rider.

Utilization of this project would be low compared to other bus expansion projects proposed. The project would be cost effective overall compared to other bus expansion projects, operating costs per new passenger are good while capital costs per new transit rider receive a medium rating compared to other bus expansion projects. The project would result in a moderate positive impact on air quality, the actual reductions would be low but the capital cost per unit of reduction receives a medium score. Connectivity between several existing bus routes would be improved, providing new one transfer service from a number of Newton communities.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Environ. Justice
Line Extension/ New Line	❍	❍	●	◗	❍	❍

MAP 5C-47 OPERATE HIGH-FREQUENCY RIVERSIDE-JFK/UMASS COMMUTER RAIL SERVICE



OPERATE HIGH-FREQUENCY RIVERSIDE–JFK/UMASS COMMUTER RAIL SERVICE

Description

This project would institute new commuter rail service between the MBTA's Riverside terminal in Newton and the JFK/UMass station in Dorchester using portions of the routes of the Framingham/Worcester Line and the Old Colony lines, but by-passing South Station. This service would be in addition to, rather than in place of, other service on those lines.

Capital Features

This project would consist of new service over existing lines. It would require one new commuter rail platform, at Riverside, and four new train sets. The cost calculations assume that these would each be two-car diesel multiple unit (DMU) trains.

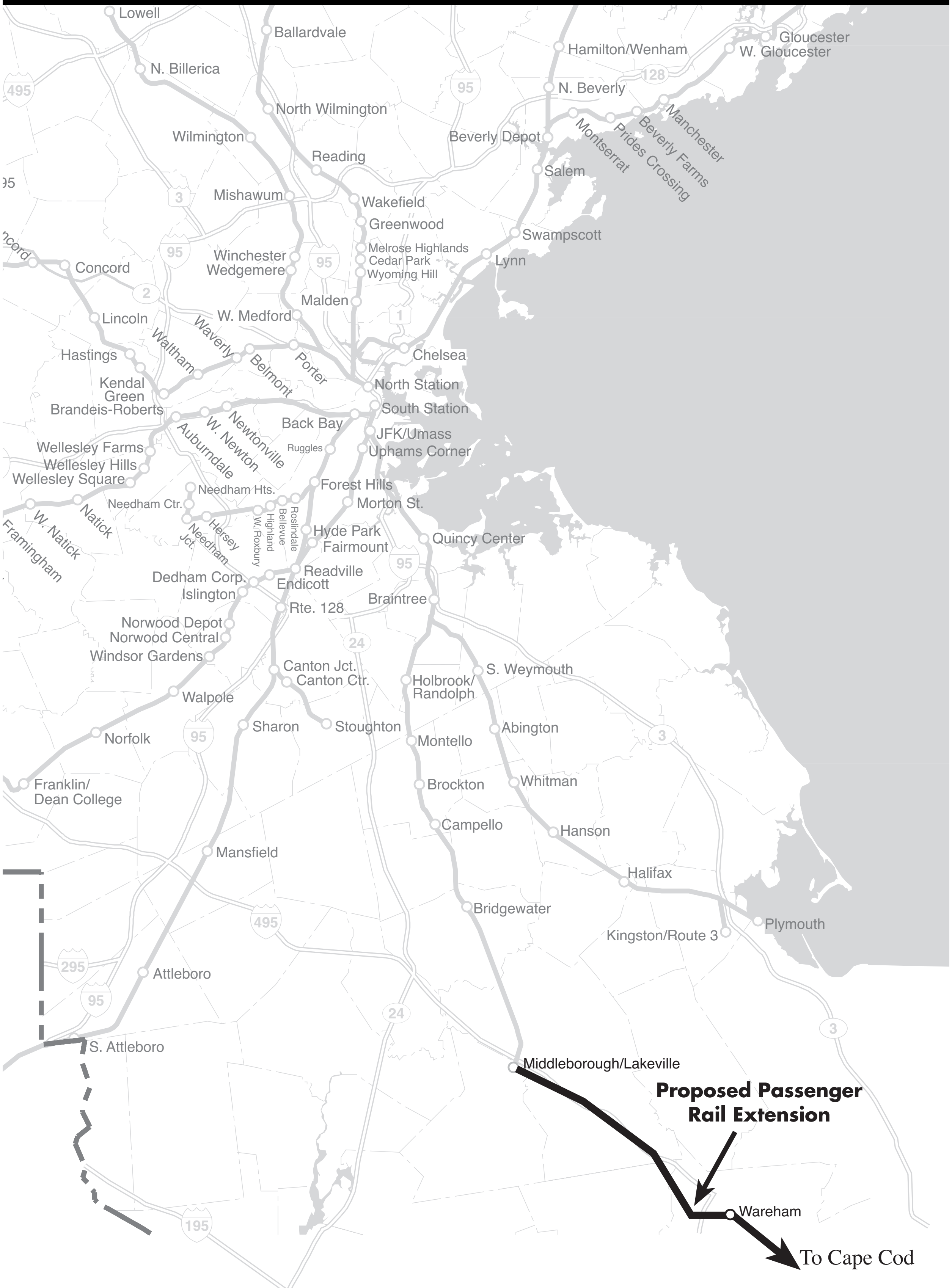
Capital Cost	**$31.5 million (CTPS estimate)**
Operating Cost	**$17,800 per day**
Daily Ridership Increase on Mode	**2,200**
Net Increase in Daily Transit Ridership	**100**
Capital Cost per New Transit Rider	**$314,700**
Operating Cost per Wkday/New Transit Rider	**$177.90**
Capital Cost/Travel Time Benefit	**$715,300 per hour**
Operating Cost/Travel Time Benefit	**$404.30 per hour**
Travel Time Savings	**44 hours per weekday**

Assessment

Overall, this project is rated low priority. It would rank in the upper mid-range of commuter rail projects in total ridership, but would be near the bottom of the mid-range in new transit ridership. The capital cost would be near the lower end of the mid-range among commuter rail projects in absolute terms, but because of the limited ridership, the cost per new rider would be among the highest for all such projects. Likewise, the absolute operating cost would be relatively low, but the cost per new transit rider would be high. Because most of the riders would be diverted from other transit services, and the route would be operated with internal combustion powered trains, it would result in a net worsening of air quality. The main benefit of this project would be in providing new through service between the Fenway and Back Bay areas and the station serving UMass Boston and the JFK Library. (Shuttle bus connections from the station to those sites would still be required.) It would, however, be among the more costly projects in both capital and operating cost per hour of travel time saved per day. Routing conflicts between this service and other South Side commuter rail routes could result in an overall degradation of service on the system.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Economic/ Land Use Impacts	Environ. Justice
Line Extension	◗	❍	❍	❍	❍	◗	◗

MAP 5C-48 EXTEND PASSENGER RAIL SERVICE FROM WAREHAM TO HYANNIS



EXTEND PASSENGER RAIL SERVICE FROM WAREHAM TO HYANNIS

Description

This project would further extend rail passenger service beyond what is proposed for the Middleborough/Wareham commuter rail extension, along an existing rail freight line to Hyannis. Through passenger service from Hyannis to Boston on this route was last operated in 1959. During summer months from 1984 to 1988 connecting service was operated from Hyannis to the Braintree Red Line station.

Capital Features

This would be a 28.9 mile extension (in addition to the 13.5 mile extension required to reach Wareham) with stations in Bourne, Sandwich, and Barnstable, including some park-and-ride facilities. This line was extensively rehabilitated in the 1980s for seasonal intercity passenger service. Upgrading for passenger rail service would include completion of a signal system that is already partly in place and some replacement of ties. Increased running time would require two additional train sets to maintain schedules.

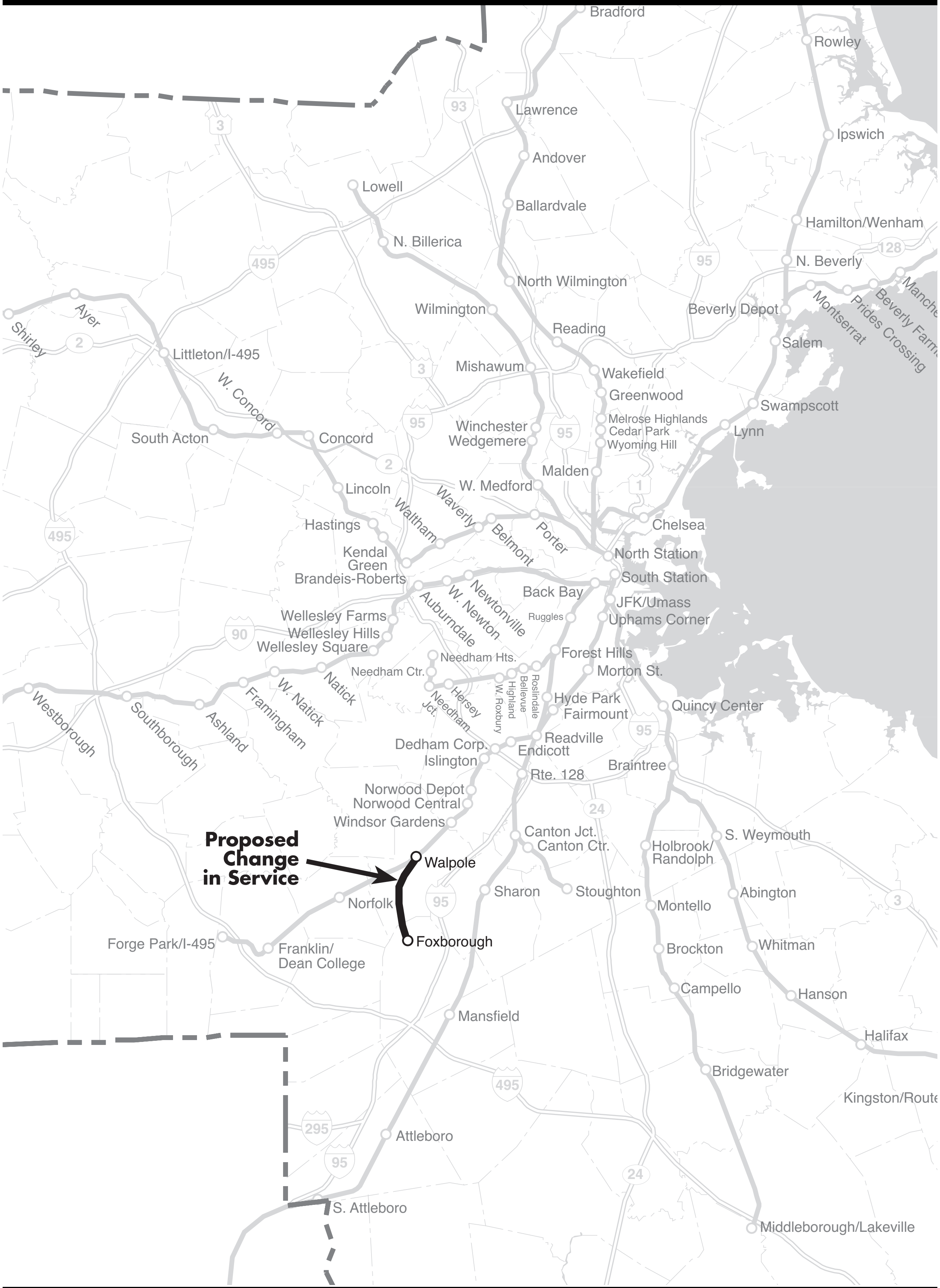
Capital Cost	**$77.1 million (CTPS estimate)**
Operating Cost	**$35,300 per weekday**
Daily Ridership Increase on Mode	**1,800**
Net Increase in Daily Transit Ridership	**1000**
Capital Cost per New Transit Rider	**$79,500**
Operating Cost per Wkday/New Transit Rider	**$36.30**
Capital Cost/Travel Time Benefit	**$196,200 per hour**
Operating Cost/Travel Time Benefit	**$89.00 per hour**
Travel Time Savings	**390 hours per weekday**

Assessment

The overall rating of this project is low priority. It would provide direct rail service to an area that is currently served by frequent express bus service to Boston. Capital costs would be near the lower end of the mid-range of costs among commuter or other passenger rail extensions examined, but because of the limited ridership, capital cost per new rider would be among the highest for projects with similar absolute costs. Operating cost per new rider would also be relatively high. It would be among the better projects in impact on air quality. Emissions of CO, CO2, and VOC would be reduced, but those of NOx would increase. This project is not intended to serve a commuting population; it would instead serve as a congestion mitigation measure for tourist traffic. Consequently, it would not benefit environmental justice target communities.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Economic/ Land Use Impacts	Environ. Justice
Line Extension	◗	❍	❍	●	❍	❍	❍

MAP 5C-49 OPERATE FULL TIME SERVICE TO FOXBORO STATION



OPERATE FULL TIME SERVICE TO FOXBORO STATION

Description

This project would implement full-time commuter rail service over an existing rail freight line that diverges from the Franklin Line at Walpole Station and runs past Gillette Stadium in Foxborough. Since the 1970s the MBTA has operated special trains to football games and other events at the stadium and the previous one that it replaced. Regularly scheduled passenger service on the line ended in 1933, and was never oriented toward Boston commuting.

Capital Features

This would be a 3.7-mile extension. Present track condition is adequate for the stadium trains but extensive upgrading of track and signals would be needed to allow attractive commuter service. The track layout at Walpole station would require a second platform there. Additional rolling stock would be needed for the Foxborough trains.

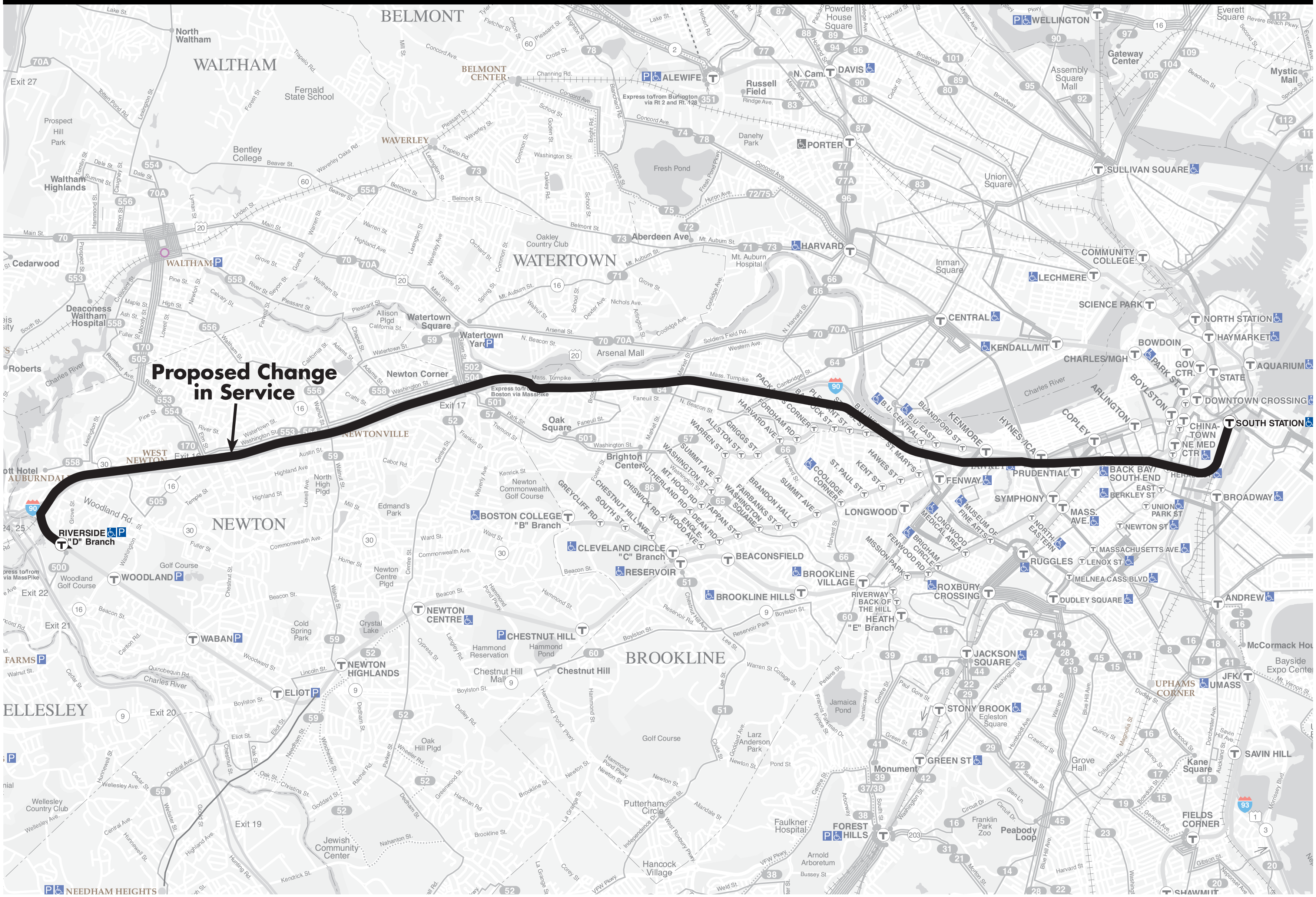
Capital Cost	**$71.3 million (CTPS estimate)**
Operating Cost	**$33,600 per day**
Daily Ridership Increase on Mode	**800**
Net Increase in Daily Transit Ridership	**600**
Capital Cost per New Transit Rider	**$113,100**
Operating Cost per Wkday/New Transit Rider	**$53.30**
Capital Cost/Travel Time Benefit	**$537,700 per hour**
Operating Cost/Travel Time Benefit	**$253.50 per hour**
Travel Time Savings	**133 hours per weekday**

Assessment

Overall, this project is rated low-priority. It would be near the lower end of the mid-range in terms of commuter rail riders and new transit users attracted and also in terms of air quality benefits among all commuter rail projects examined for the PMT. The cost per new transit rider would be at the upper end of the mid range for such projects. It would serve only one station not on the present Franklin Line, and it would not be located in an environmental justice target community. The significant parking available at Gillette Stadium does provide an option to alleviate parking demand in that area.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Economic/ Land Use Impacts	Environ. Justice
Line Extension	❍	◗	❍	◗	❍	❍	❍

MAP 5C-50 OPERATE HIGH FREQUENCY RIVERSIDE–SOUTH STATION COMMUTER RAIL SERVICE



❍ OPERATE HIGH FREQUENCY RIVERSIDE–SOUTH STATION COMMUTER RAIL SERVICE

Description

This project would institute new commuter rail service between the Riverside MBTA terminal in Newton and South Station via the Framingham/ Worcester Line. This service would be in addition to, rather than in place of, other service on that line.

Capital Features

This project would consist of new service over an existing line. It would require one new commuter rail platform, at Riverside, and four new train sets. The cost calculations assume that these would each be two-car diesel multiple unit (DMU) trains.

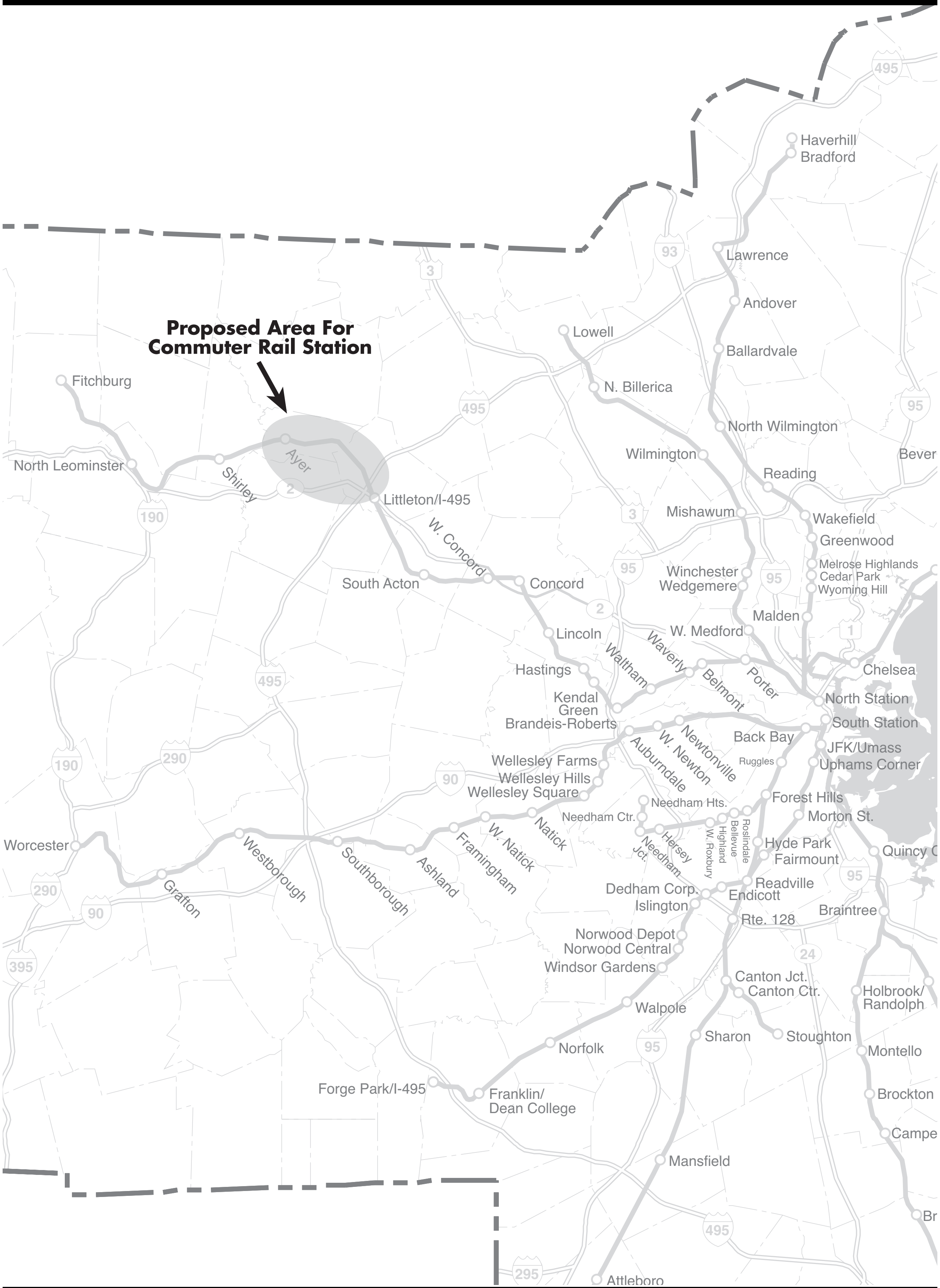
Capital Cost	**$31.5 million (CTPS estimate)**
Operating Cost	**$16,000 per day**
Daily Ridership Increase on Mode	**800**
Net Increase in Daily Transit Ridership	**130**
Capital Cost per New Transit Rider	**$242,100**
Operating Cost per Wkday/New Transit Rider	**$122.80**
Capital Cost/Travel Time Benefit	**$1,165,700 per hour**
Operating Cost/Travel Time Benefit	**$591.00 per hour**
Travel Time Savings	**27 hours per weekday**

Assessment

Overall, this project is rated low priority. It would attract relatively few total riders or new transit riders. The capital cost would be near the lower end of the mid-range among commuter rail projects in absolute terms, but because of the limited ridership, the cost per new rider would be among the highest for all such projects. Likewise, the absolute operating cost would be relatively low, but the cost per new transit rider would be high. Because most of the riders would be diverted from other transit services, and the route would be operated with internal combustion powered trains, it would result in a net worsening of air quality. The main benefits of this project would be in relieving crowding on other trains on the inner end of the Framingham/ Worcester Line and in providing an alternative to the Green Line or express buses for travel from Riverside to downtown Boston. It would, however, be among the more costly projects in both capital and operating cost per hour of travel time saved per day. Competition for scarce track space at South Station during peak hours could result in an overall degradation of service on the system.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Economic/ Land Use Impacts	Environ. Justice
Line Extension	❍	❍	❍	❍	❍	◗	❍

MAP 5C-51 BUILD COMMUTER RAIL STATION ALONG RT 2 AT OR NEAR I-495



BUILD COMMUTER RAIL STATION ALONG RT 2 AT OR NEAR I-495

Description

This project would relocate a station on the Fitchburg commuter rail line in or near the former Fort Devens complex on the border of Ayer and Shirley.

Capital Features

This project would consist of one new station with a regional parking facility (500 spaces) on an existing line. No upgrading of tracks would be needed. No new rolling stock would be required to accommodate the additional riders.

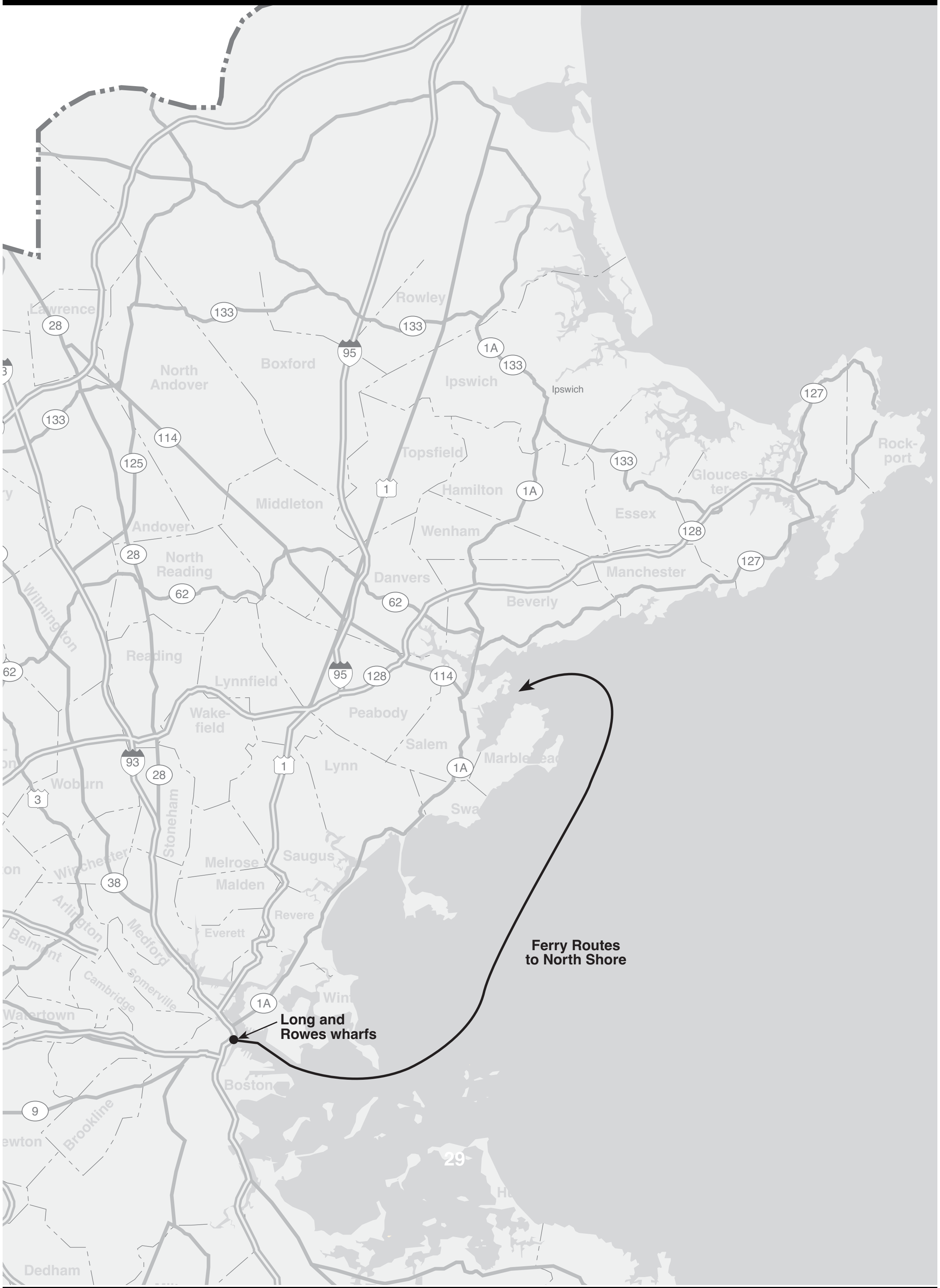
Capital Cost	**$8.2 million (MBTA Planning Dept. estimate)**
Operating Cost	**None, if one existing station is discontinued**
Daily Ridership Increase on Mode	**100**
Net Increase in Daily Transit Ridership	**40**
Capital Cost per New Transit Rider	**$205,000**
Operating Cost per Wkday/New Transit Rider	**Too small to calculate**
Capital Cost/Travel Time Benefit	**$424,100 per hour**
Operating Cost/Travel Time Benefit	**Too small to calculate**
Travel Time Savings	**19 hours per weekday**

Assessment

Overall, this project is rated low priority. It would attract few total riders or new transit riders. The capital cost would be relatively small in absolute terms, but because of the low ridership, the cost per new rider would be at the high end of such costs among commuter rail expansion projects. However, because of the relatively large saving in VMT for each new transit user, and the ability to serve the station with no change in train-miles, cost-effectiveness of air quality improvements would fall in the mid-range for commuter rail expansions. The project has a low rating for economic and land-use impacts, as it would not satisfy any of the goals in that category. It would not serve any environmental justice target communities.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Economic/ Land Use Impacts	Environ. Justice
New Station	❍	❍	❍	◗	❍	❍	❍

MAP 5C-52 HIGH SPEED FERRY FROM NORTH SHORE TO BOSTON & THE AIRPORT



HIGH SPEED FERRY FROM NORTH SHORE TO BOSTON AND THE AIRPORT

Description

This project would implement a new high-speed commuter boat route from Salem to Logan Airport and the downtown Boston waterfront. A similar route was run experimentally in 1998, but with much less frequent service than analyzed here.

Capital Features

This route would require acquisition of five medium-size high-speed commuter boats, and construction of a new terminal in Salem with park-and-ride facilities.

Capital Cost	**$16.3 million (CTPS estimate)**
Operating Cost	**$12,400 per day**
Daily Ridership Increase on Mode	**350**
Net Increase in Daily Transit Ridership	**100**
Capital Cost per New transit Rider	**$162,900**
Operating Cost per Wkday/New transit Rider	**$123.80**
Capital Cost/Travel Time Benefit	**$723,900 per hour**
Operating Cost/Travel Time Benefit	**$551.10 per hour**
Travel Time Savings	**23 hours per weekday**

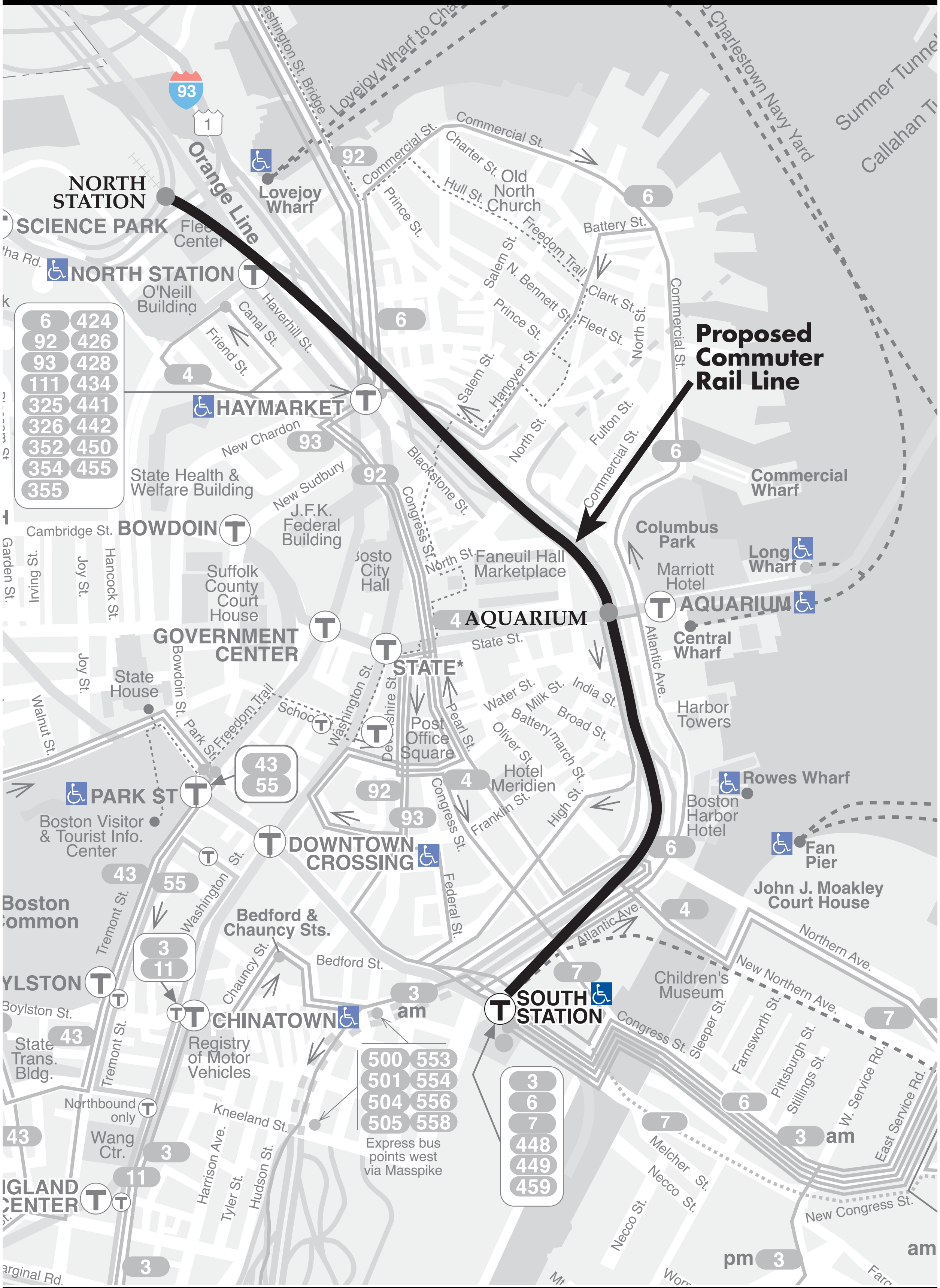
Assessment

This project would provide a new alternative for travel from the North Shore to downtown Boston and Logan Airport, but would have to compete for ridership with several well-established transit alternatives. The capital cost per new transit rider would be the highest among water transportation projects examined for the PMT, (when the South Shore improvements are considered as one project) and the operating cost per new rider would be the second-highest. The Salem terminal would be in a state-designated revitalization area, but the route would not serve any mixed-use development projects on the North Shore directly. Overall, this project is rated low priority.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Economic/ Land Use Impacts	Environ. Justice
Line Extension New Line	◗	❍	❍	❍	❍	◗	◗

Multi-State Expansion Projects

MAP 5C-53 NORTH-SOUTH RAIL LINK



NORTH–SOUTH RAIL LINK

Description

This project would provide a connection through downtown Boston between the rail lines that terminate at North Station and those that terminate at South Station, allowing through-routing of trains between North Side and South Side lines.

Capital Features

This project would consist of a four-track tunnel over one mile long, with new underground stations in the vicinities of North Station, South Station and a new central station near the Aquarium rapid transit station.

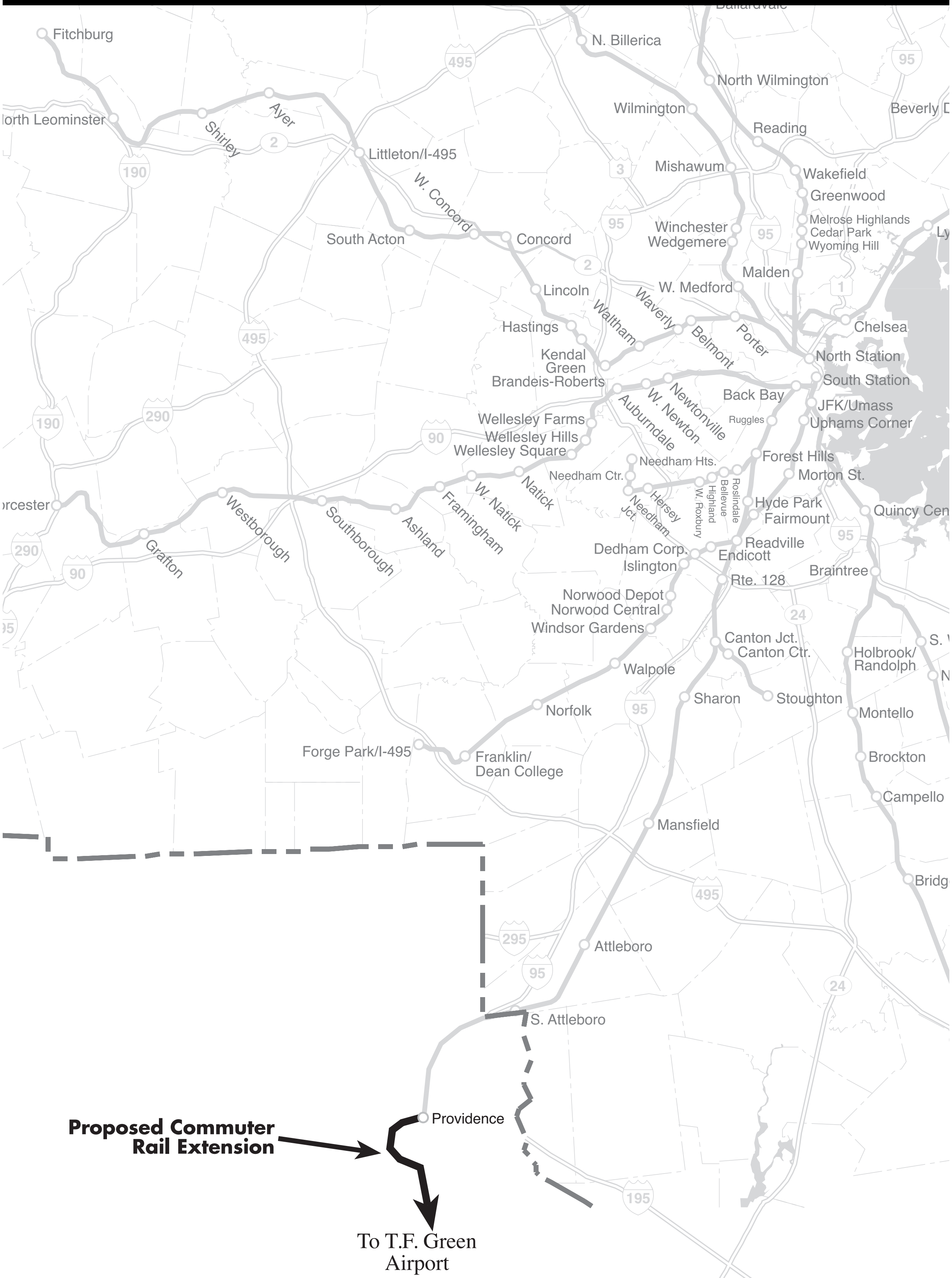
Capital Cost	**$8.7 billion (MBTA Planning Dept. estimate)**
Operating Cost	**$231,000 per weekday (including service changes on entire commuter rail system directly related to the Rail Link)**
Daily Ridership Increase on Mode	**96,100**
Net Increase in Daily Transit Ridership	**54,400**
Capital Cost per New Transit Rider	**$160,100**
Operating Cost per Wkday/New Transit Rider	**$4.20**
Capital Cost/Travel Time Benefit	**$490,700 per hour**
Operating Cost/Travel Time Benefit	**$13.00 per hour**
Travel Time Savings	**17,730 hours per weekday**

Assessment

Overall, this project is rated high-priority. It would attract the largest numbers of commuter rail riders and new transit users of all commuter rail projects examined for the PMT. In absolute terms, it would be by far the costliest project examined, but because of the high ridership, the cost per new transit rider would be at the upper end of the mid-range among commuter rail projects. It would improve distribution of commuter rail passengers within downtown Boston, open up new possibilities for travel between points on North Side and South Side commuter rail lines, improve efficiency of train operations, and help relieve capacity constraints at the Boston terminals. It would result in the largest absolute travel time savings of any commuter rail project examined for the PMT. It would also be beneficial to projects to restore intercity rail passenger service to points north of Boston, both within Massachusetts and beyond. Consequently, it is expected that it would be funded at least in part through sources dedicated for intercity transportation improvements. It is rated high priority in economic and land use impacts because the new central station would be in a state-designated revitalization area, where local plans call for mixed-use transit-oriented development. This would include industrial and high-density residential uses.

Type of Project	Utilization	Mobility	Cost–Effectiveness	Air Quality	Service Quality	Economic/Land Use Impacts	Environ. Justice
Line Extension	●	◗	◗	◗	◗	●	◗

MAP 5C-54 EXTEND COMMUTER RAIL FROM PROVIDENCE TO T. F. GREEN (RI)



D EXTEND COMMUTER RAIL FROM PROVIDENCE TO T. F. GREEN (RI)

Description

This project would extend commuter rail service along the Amtrak Northeast Corridor route between Providence, Rhode Island and T. F. Green Airport in Warwick, Rhode Island. Passenger service making local stops on this line segment was last operated in 1981, and had consisted of only one round trip per day for many years before that. This project is an ACO legal commitment (see table 2-2).

Capital Features

This would be an 8.5-mile extension, with one new station, including a major park-and-ride facility near the airport, with a people-mover connection to the airline terminals. Trains would operate either on the existing Northeast Corridor tracks or on an adjoining freight by-pass track being planned by the state of Rhode Island. Capital costs would be mostly those for rolling stock and for the terminal station.

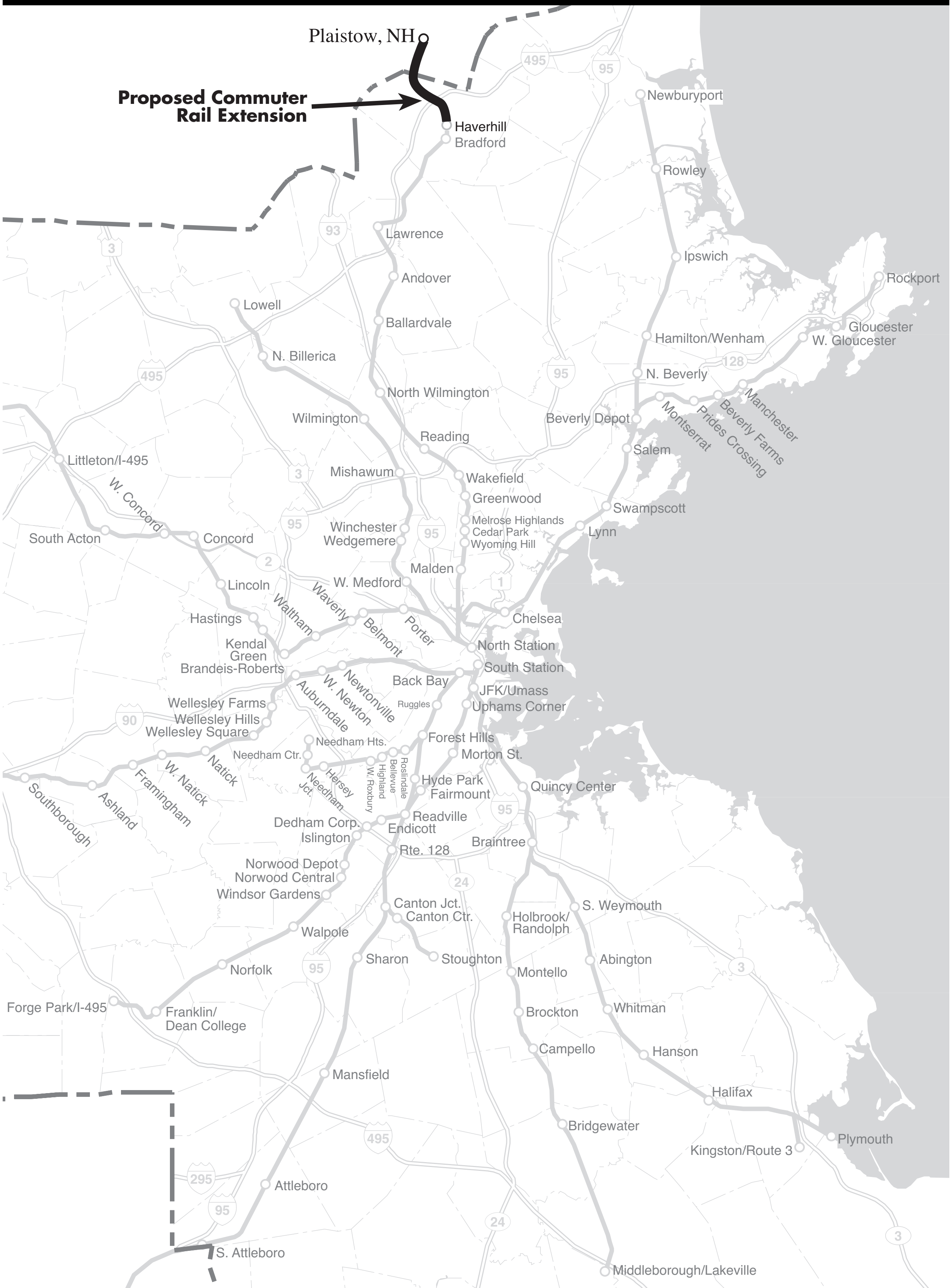
Capital Cost	**$42.8 million (Based on 2001 South County Commuter Rail Service Study adjusted to 2003)**
Operating Cost	**$10,400 per weekday**
Daily Ridership Increase on Mode	**1,500**
Net Increase in Daily Transit Ridership	**900**
Capital Cost per New Transit Rider	**$66,667**
Operating Cost per Wkday/New Transit Rider	**$11.52**
Capital Cost/Travel Time Benefit	**$149,700 per hour**
Operating Cost/Travel Time Benefit	**$36.20 per hour**
Travel Time Savings	**286 hours per weekday**

Assessment

The overall rating of this project is medium priority. Ridership would be near the lower end of the mid-range among commuter rail extension projects examined. It would restore rail transit service to an area that is now served by much slower bus connections to commuter rail at Providence, and would also improve options for travel to the largest airport in the state of Rhode Island. This airport also has many users from Massachusetts, but because of scattered origins, not all would be able to take advantage of rail service. This project was initiated by the state of Rhode Island, and is contingent on arrangement of funding by that state. A feasibility study conducted for Rhode Island indicates that for operational reasons the extension should continue at least as far as Wickford Junction, 19.3 miles from Providence, rather than terminating at the airport. This would increase the capital and operating costs, but would also attract much greater ridership, according to the study. Many of these riders would, however, be traveling entirely within Rhode Island, and would be best served by trains on different schedules from those running through to Boston.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Economic/ Land Use Impacts	Environ. Justice
Line Extension	◗	●	◗	◗	◗	❍	❍

MAP 5C-55 EXTEND COMMUTER RAIL FROM HAVERHILL TO PLAISTOW, NH



D EXTEND COMMUTER RAIL FROM HAVERHILL TO PLAISTOW, NH

Description

This project would implement commuter service on an existing rail freight and intercity passenger service line, from the end of the Haverhill Line to Plaistow, New Hampshire. Commuter service was last operated on this line in 1967. Intercity service from Portland, Maine was restored in 2001 after extensive track upgrading.

Capital Features

Commuter rail service would be extended for 5.4 miles beyond its present limit, but no additional track upgrading would be needed. One new station with parking facilities would be built in Plaistow. One additional train set would be required to maintain schedules because of the increased running time.

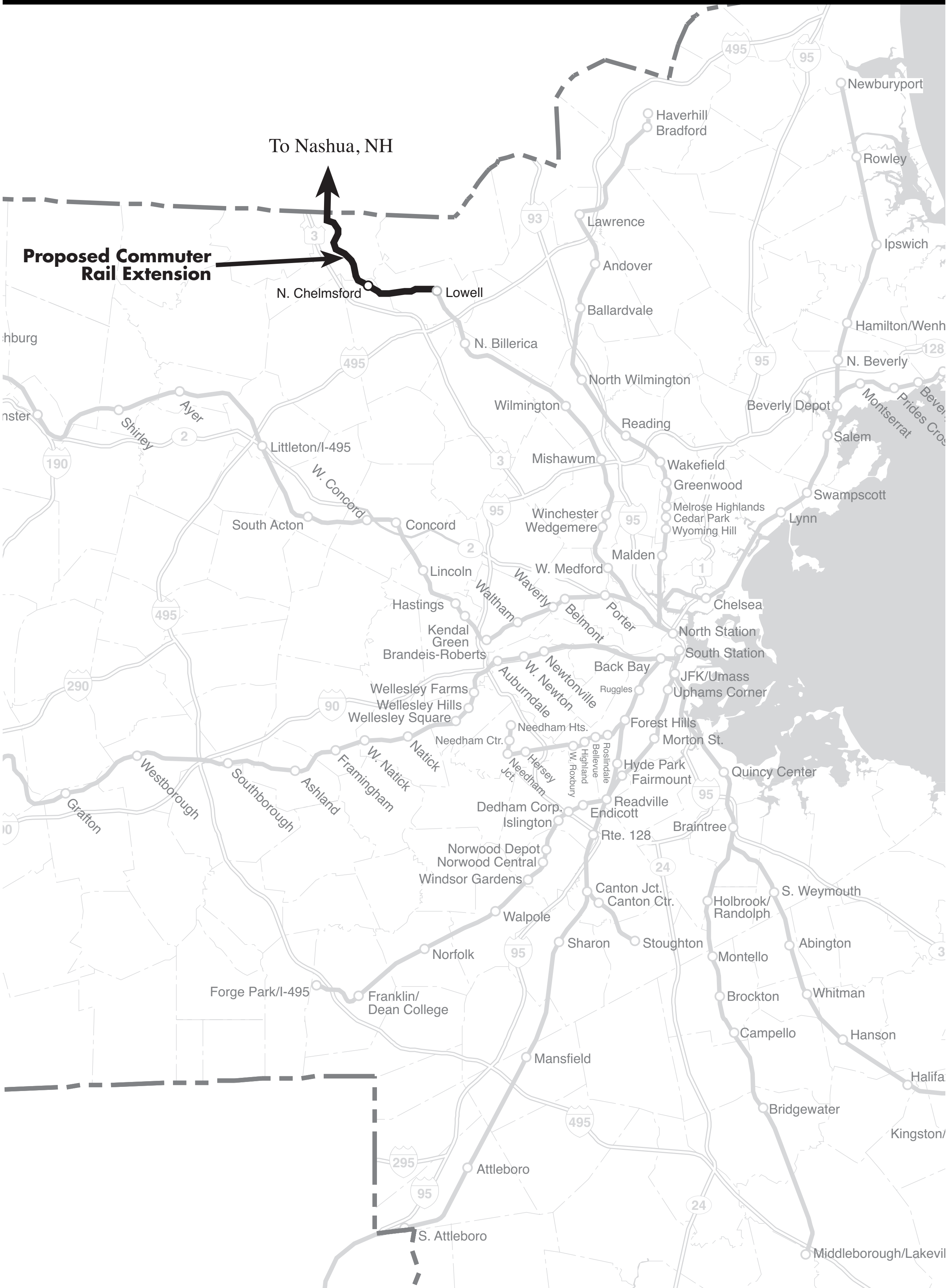
Capital Cost	**$21.8 million (CTPS estimate)**
Operating Cost	**$7,100 per weekday**
Daily Ridership Increase on Mode	**1,700**
Net Increase in Daily Transit Ridership	**1,300**
Capital Cost per New Transit Rider	**$16,600**
Operating Cost per Wkday/New Transit Rider	**$5.40**
Capital Cost/Travel Time Benefit	**$77,100 per hour**
Operating Cost/Travel Time Benefit	**$24.80 per hour**
Travel Time Savings	**282 hours per weekday**

Assessment

Overall, this project is rated medium priority. It would attract substantial total and new ridership relative to the increased route length. It would provide direct rail service to an area that now has infrequent express bus service to Boston, but is also close to the existing Haverhill terminal. The total capital cost and cost per new transit rider would be among the lowest of any commuter rail expansion projects, because the route has recently been upgraded for intercity passenger service. It would be among the better projects in air quality improvements because of the large number of auto diversions and the small number of additional train-miles. Almost all of the riders would be New Hampshire residents, so this project would be contingent on arrangement of funding by New Hampshire.

Type of Project	Utilization	Mobility	Cost-Effectiveness	Air Quality	Service Quality	Economic/ Land Use Impacts	Environ. Justice
Line Extension	●	❍	●	●	❍	❍	❍

MAP 5C-56 EXTEND COMMUTER RAIL FROM LOWELL TO NASHUA



D EXTEND COMMUTER RAIL FROM LOWELL TO NASHUA

Description

This project would implement commuter service on an existing rail freight line from the end of the Lowell Line to Nashua, New Hampshire. Passenger service was last operated on this line in 1981.

Capital Features

This would be a 13-mile extension, including one new station in Massachusetts at North Chelmsford and one or two new stations in New Hampshire. Extensive upgrading of tracks and signals would be required.

Capital Cost	**$35.5 million (Nashua Regional Planning Commission estimate)**
Operating Cost	**$29,000 per weekday**
Daily Ridership Increase on Mode	**3,100**
Net Increase in Daily Transit Ridership	**2,200**
Capital Cost per New Transit Rider:	**$16,100**
Operating Cost per Wkday/New Transit Rider	**$13.10**
Capital Cost/Travel Time Benefit	**$98,100 per hour**
Operating Cost/Travel Time Benefit	**$80.20 per hour**
Travel Time Savings	**362 hours per weekday**

Assessment

Overall, this project is rated medium priority. It would be one of the better commuter rail expansion projects examined in terms of the numbers of new transit riders and total riders served, and would serve an area with very limited existing transit service. It would also be one of the better commuter rail expansion projects in terms of air quality impacts. Emissions of CO, CO2, and VOC would be reduced, but those of NOx would increase. Capital costs for this project would be in the mid-range of costs among commuter rail extensions examined. It would be among the more cost-effective projects in terms of capital and operating costs per new transit rider. This would be a joint project with the state of New Hampshire, and would be contingent on arrangement of funding by New Hampshire.

Type of Project	Utilization	Mobility	Cost-- Effectiveness	Air Quality	Service Quality	Economic/ Land Use Impacts	Environ. Justice
Line Extension	●	●	◗	●	❍	❍	❍

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P M T

APPENDIX A

System Expansion and Service Enhancement Project Performance Measures

EXPLANATION OF MEASURES

System Expansion and Service Enhancement project ideas were evaluated based on 32 individual performance measures divided into 7 categories. Each of these categories and their component measures are listed and described below. In some cases, certain performance measures were listed as not applicable. This was especially common with service enhancement projects with no quantifiable ridership impact.

Project ideas were also divided into a number of different categories based on the nature of the project. First, system expansion projects were separated from service enhancement projects. In general, system expansion projects would result in the coverage area or span of service for a given mode expanding beyond what is currently provided. Service enhancement projects, however, would improve the quality of service provided on an existing transit line or at an existing station.

Project ideas were then further divided by mode. Commuter rail, rapid transit, bus/trackless trolley, and boat ideas were evaluated separately. This resulted in seven overall groupings of projects – system expansion and service enhancement projects for all modes except for boat. Only system expansion projects were submitted for consideration under the boat mode.

For each performance measure that was applicable to a given project, a high, medium, or low rating was assigned. In the case of quantitative measures, the thresholds for high, medium, and low ratings were defined by first listing the corresponding impacts of each project in order of magnitude. Natural breaks (large gaps between the impacts of successive projects in the list) were then identified and the first grouping was given a high rating, the second group a medium ratings, and so on. This resulted in a set of ratings for individual projects that were relative in nature.

In the case of qualitative measures, the thresholds for high, medium, and low ratings were defined before their application to specific project ideas. Additional details on these definitions for each measure are included below. In some cases, the vast majority of project ideas received the same rating on a given qualitative performance measure, unlike the approach for quantitative measures. For example, almost all project ideas that would have an impact on environmental justice target communities were determined to result in a greater benefit than burden to those communities. Consequently, almost all projects received high ratings on the measure called *Burdens and Benefits to Minority, Low Income, and Transit Dependent Neighborhoods*.

Descriptions of performance measures, by category, are as follows.

Utilization

Total Ridership

- Projected increase in the number of weekday riders using the mode(s) corresponding to the transit line or station to be improved

New Transit Riders

- Projected increase in the number of weekday riders on the transit system as a whole

Travel Time Benefit

- Projected cumulative reduction in travel time experienced by all travelers in the region

Impact on Mode Share to Key Destinations Including Downtown Boston

- Projected percentage increase in weekday transit mode share, systemwide

Reduction in Crowding

- Projected reduction in weekday load factor on the transit line impacted by the project

Reduction in Vehicle Miles Traveled

- Projected percentage reduction in weekday automobile vehicle miles traveled, regionwide

Mobility

Expansion of Transit Access to Geographical Areas Underserved by Transit

Projects receiving a high rating would:

- Initiate a new transit line or extend an existing line along a corridor connecting multiple urban neighborhoods or suburban municipalities not served by the MBTA or other Boston commuter services, or
- Fill gaps in the rapid transit/commuter rail network in urban core communities.

Projects receiving a medium rating would:

- Extend the rapid transit network beyond its current service area in multiple urban neighborhoods or suburban municipalities already served by transit, or
- Add additional rapid transit/commuter rail access points in an urban neighborhood or suburban municipality not currently served by that mode, or
- Initiate transit service along a corridor connecting multiple urban neighborhoods or suburban municipalities where existing commuter bus service serves the same market.

Expansion of Transit Access During Time Periods Poorly Served by Transit

Projects receiving a high rating would:

- Provide transit service to an urban neighborhood or suburban municipality during a time period not served by an existing well-utilized MBTA or Boston commuter transit line in that community.

Projects receiving a medium rating would:

- Provide transit service to an urban neighborhood or suburban municipality during a time period not served by an existing lightly-utilized MBTA or Boston commuter transit line in that community.

Expansion of Transit Access to a Major Employment Center Underserved by Transit

Projects receiving a high rating would:

- Initiate a new transit line or extend an existing line to a large urban community outside Boston, or
- Initiate rapid transit/commuter rail service to a major employment center along a corridor not currently served by that mode.

Projects receiving a medium rating would:

- Initiate a new transit line or extend an existing line to a small urban community outside Boston.

Cost Effectiveness

Capital Cost Per New Transit Rider

- Ratio between the capital cost of the project and the projected increase in the number of weekday riders on the transit system as a whole

Operating Cost Per New Transit Rider

- Ratio between typical weekday operating cost of the project and the projected increase in the number of weekday riders on the transit system as a whole

Capital Cost Per Unit Travel Time Savings

- Ratio between the capital cost of the project and the projected cumulative reduction in travel time experienced by all travelers in the region.

Operating Cost Per Unit Travel Time Savings

- Ratio between the typical weekday operating cost of the project and the projected cumulative reduction in travel time experienced by all travelers in the region.

Air Quality

Percent Reduction in Volatile Organic Compound (VOC) Emissions

- Projected percentage reduction in VOC emissions on weekdays, regionwide

Percent Reduction in Nitrogen Oxide (NOx) Emissions

- Projected percentage reduction in NOx emissions on weekdays, regionwide

Percent Reduction in Carbon Monoxide (CO) Emissions

- Projected percentage reduction in CO emissions on weekdays, regionwide

Percent Reduction in Carbon Dioxide (CO_2) Emissions

- Projected percentage reduction in CO_2 emissions on weekdays, regionwide

Capital Cost Per Unit Reduction in VOC Emissions

- Ratio between the capital cost of the project and the projected reduction in VOC emissions on weekdays, regionwide

Capital Cost Per Unit Reduction in NOx Emissions

- Ratio between the capital cost of the project and the projected reduction in NOx emissions on weekdays, regionwide

Capital Cost Per Unit Reduction in CO Emissions

- Ratio between the capital cost of the project and the projected reduction in CO emissions on weekdays, regionwide

Capital Cost Per Unit Reduction in CO_2 Emissions

- Ratio between the capital cost of the project and the projected reduction in CO_2 emissions on weekdays, regionwide

Service Quality

Enhancements to Customers' Personal Safety

Projects receiving a high rating would:

- Enhance the personal safety and security of passengers and provide MBTA operating personnel with improved means of responding to on-board emergencies.

Projects receiving a medium rating would:

- Enhance the personal safety and security of passengers.

Improvements to Station Access and/or Comfort of Vehicles and Stations

Projects receiving a high rating would:

- Improve the access to stations or comfort of vehicles or stations for a large portion of passengers on a transit line.

Projects receiving a medium rating would:

- Improve the access to stations or comfort of vehicles or stations for a small portion of passengers on a transit line.

Improvements to Reliability of Service

Projects receiving a high rating would:

- Improve the schedule adherence of an existing bus line by removing vehicles from mixed traffic and placing them in an exclusive right-of-way, or
- Provide operating personnel with improved means of correcting schedule adherence problems in real time
- Improve the schedule adherence of an existing rapid transit or commuter rail line by expanding the capacity of constricted sections.

Projects receiving a medium rating would:

- Improve the schedule adherence of an existing bus line by removing vehicles from mixed traffic and placing them in a prioritized right-of-way, or
- Provide operating personnel with improved means of identifying schedule adherence problems on transit lines.

Improvements to Interconnectivity Between Modes (Including Non-Motorized Modes)

Projects receiving a high rating would:

- Initiate new connectivity to an additional mode for an existing transit line, or
- Initiate new connectivity to an additional rapid transit line for an existing rapid transit line, or
- Substantially expand the number of destinations accessible by a single bus-rapid transit transfer for an existing rapid transit line.

Projects receiving a medium rating would:

- Provide an additional transfer point between two lines already connected elsewhere, or
- Expand the number of destinations accessible by a single bus-rapid transit transfer for an existing rapid transit line.

Customer Information Including Navigational Tools

Projects receiving a high rating would:

- Directly improve the amount of route planning or service performance information available to passengers.

Projects receiving a medium rating would:

- Facilitate the provision of additional route planning or service performance information available to passengers.

Elimination of Transfers/Minimization of Transfer Time

Projects receiving a high rating would:

- Reduce the number of transfers necessary for residents of multiple urban neighborhoods or suburban municipalities to reach major employment centers, or
- Substantially reduce overall transit travel time by improving the efficiency of vehicle-vehicle transfers.

Projects receiving a medium rating would:

- Reduce the number of transfers necessary for residents of an urban neighborhood or suburban municipality to reach major employment centers.

Economic and Land Use Impacts

Service to a State-Designated Revitalization Area/Initiative

Projects receiving a high rating are those for which:

- At least 2/3 of the stations along the line are located in Economically Distressed Areas (EDAs).

Projects receiving a medium rating are those for which:

- At least 1/3 of the stations along the line are located in EDAs.

Consistency With Local Plans That Promote Coordinated, Transit-Oriented Development and Support Sustainable Land Use Patterns In the Immediately Surrounding Area(s)

Projects receiving a high rating are those for which:

- At least 1/2 of the stations along the line are located in areas zoned for mixed-use development.

Projects receiving a medium rating are those for which:

- At least 1/2 of the stations along the line are located in areas zoned for both high density residential and commercial development, or zoned for industrial development.

Consistency with Regional Plans

Projects receiving a high rating are those for which:

- At least 1/2 of the stations along the line are located in urban areas or Concentrated Development Centers (CDC).

Projects receiving a medium rating are those for which:

- At least 1/2 of the stations along the line are located in urban areas or multi-service areas.

Support for Brownfield and Infill Development

Projects receiving a high rating would:

- Entirely serve a large brownfield site.

Projects receiving a medium rating are those for which:

- At least 1/2 of the stations along the line are located near an EOEA-designated 21E site.

Environmental Justice

Service to Minority, Low Income, and Transit Dependent Neighborhoods

Projects receiving a high rating would:

- Almost exclusively serve communities that meet at least two of the following three environmental justice target criteria: above-average minority population, median income less than 75% of regionwide median, and above 50% transit dependent population.

Projects receiving a medium rating would:

- Serve environmental justice target communities, as defined above.

Rectification of Structural and/or Operational Transportation Barriers Faced By Minority, Low Income, and Transit Dependent Neighborhoods

Projects receiving a high rating would:

- Rectify a substantial structural and/or operational transportation barrier preventing direct access from environmental justice target communities to major urban core employment centers.

Projects receiving a medium rating would:

- Rectify a minor structural and/or operational transportation barrier preventing direct access from environmental justice target communities to major urban core employment centers.

Response to Environmental Justice Issues Identified in MPO Regional Transportation Plans, Including Poor Connections Between Targeted Residential Neighborhoods and Major Employment Centers

Projects receiving a high rating would:

- Substantially address an environmental justice issue identified in a MPO Regional Transportation Plan.

Projects receiving a medium rating would:

- Partially address an environmental justice issue identified in a MPO Regional Transportation Plan.

Burdens and Benefits to Minority, Low Income, and Transit Dependent Neighborhoods

Projects receiving a high rating would:

- Provide benefits to an environmental justice target neighborhood at a level commensurate with or greater than any burdens.

Projects receiving a medium rating would:

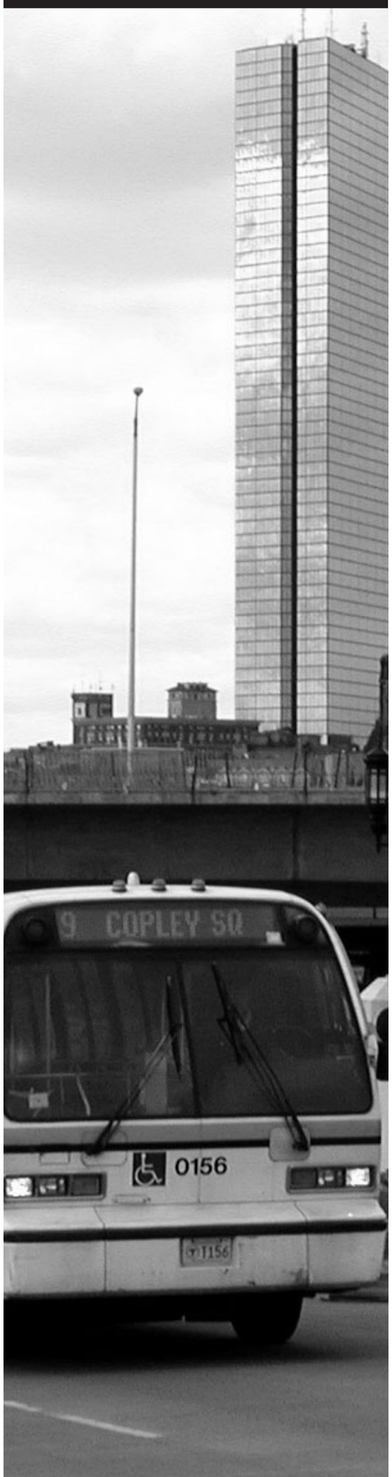
- Provide benefits to an environmental justice target neighborhood at a level less than the resulting burdens.

Projects receiving a low rating would:

- Result in a burden on an environmental justice target neighborhood without corresponding benefits.

APPENDIX B

Detailed System Expansion and Service Enhancement Project Ratings



As discussed in chapter 1 and described in greater detail in appendix A, each of the system expansion and service enhancement project ideas were evaluated according to 36 individual performance measures (when applicable). These measures were divided into 7 categories.

In this appendix, tables display the ratings of each project with respect to each performance measure. In particular, there are sets of tables for each transit mode, and within each mode there is a table for each category of performance measures. The cumulative project ratings for each of these categories are reflected in the tables, and at the bottom of each project assessment included in chapters 5B and 5C.

Project rating tables begin on the following pages:

Service Enhancement Project Evaluation Ratings

TABLE B-1 RAPID TRANSIT PROJECT EVALUATION – UTILIZATION

Project Description	Type	Ridership	New Riders	Impact on Mode Share	Reduct. in Crowd.	Reduct. in VMT	Travel Time Savings	Total
Operate 4-car trains on Green Line	Facility Improvement	◗	◗	◗	●	◗	◗	◗
Operate 8-car trains on Orange Line	Facility Improvement	◗	◗	◗	●	◗	◗	◗
Operate 8-car trains on Red Line	Facility Improvement	◗	◗	◗	●	◗	◗	◗
Signal and Train Control Imp. on Blue Line	Facility Improvement	●	●	●	●	●	◗	●
Signal and Train Control Imp. on Green Line	Facility Improvement	❍	❍	❍	❍	❍	❍	❍
Signal and Train Control Imp. on Red Line	Facility Improvement	●	●	●	●	●	◗	●
Signal and Train Control Imp.on Orange Line	Facility Improvement	●	●	●	●	●	●	●
Commonwealth Flats Silver Line Grade Separation	Travel Time Improvement	❍	❍	❍	❍	❍	❍	❍
Preemptive signals on Beacon, Commonwealth, and Huntington	Travel Time Improvement	❍	❍	❍	❍	❍	❍	❍

TABLE B-2 RAPID TRANSIT PROJECT EVALUATION – MOBILITY

Project Description	Type	Service to Areas With Unmet Demand	Service During Time Periods With Unmet Demand	Service to Underserved Employment Centers	Total
Operate 4-car trains on Green Line	Facility Improvement	❍	❍	❍	❍
Operate 8-car trains on Orange Line	Facility Improvement	❍	❍	❍	❍
Operate 8-car trains on Red Line	Facility Improvement	❍	❍	❍	❍
Signal and Train Control Imp. on Blue Line	Facility Improvement	❍	❍	❍	❍
Signal and Train Control Imp. on Green Line	Facility Improvement	❍	❍	❍	❍
Signal and Train Control Imp. on Red Line	Facility Improvement	❍	❍	❍	❍
Signal and Train Control Imp. on Orange Line	Facility Improvement	❍	❍	❍	❍
Commonwealth Flats Silver Line Grade Separation	Travel Time Improvement	❍	❍	❍	❍
Preemptive signals on Beacon, Commonwealth, and Huntington	Travel Time Improvement	❍	❍	❍	❍

TABLE B-3 RAPID TRANSIT PROJECT EVALUATION – COST EFFECTIVENESS

Project Description	Type	Capital Cost Per New Transit Rider	Operating Cost Per New Transit Rider	Capital Cost Per Unit Travel Time Savings	Operating Per Unit Travel Time Savings	Total
Operate 4-car trains on Green Line	Facility Improvement	❍	❍	❍	❍	❍
Operate 8-car trains on Orange Line	Facility Improvement	◗	◗	◗	◗	◗
Operate 8-car trains on Red Line	Facility Improvement	◗	◗	◗	◗	◗
Signal and Train Control Imp. on Blue Line	Facility Improvement	◗	●	●	●	●
Signal and Train Control Imp. on Green Line	Facility Improvement	❍	❍	❍	❍	❍
Signal and Train Control Imp. on Red Line	Facility Improvement	◗	◗	◗	◗	◗
Signal and Train Control Imp. on Orange Line	Facility Improvement	◗	●	●	●	●
Commonwealth Flats Silver Line Grade Separation	Travel Time Improvement	❍	N/A	❍	N/A	❍
Preemptive signals on Beacon, Commonwealth, and Huntington	Travel Time Improvement	●	N/A	●	N/A	●

TABLE B-4 RAPID TRANSIT PROJECT EVALUATION – AIR QUALITY

Project Description	Type	Reduct. in VOC	Reduct. in NOx	Reduct. in CO	Reduct. in CO_2	Capital Cost Per Reduct. in VOC	Capital Cost Per Reduct. in NOx	Capital Cost Per Reduct. in CO	Capital Cost Per Reduct. in CO_2	Total
Operate 4-car trains on Green Line	Facility Improve.	◗	◗	◗	◗	❍	❍	❍	❍	❍
Operate 8-car trains on Orange Line	Facility Improve.	◗	◗	◗	◗	◗	◗	◗	◗	◗
Operate 8-car trains on Red Line	Facility Improve.	◗	◗	◗	◗	◗	◗	◗	◗	◗
Signal and Train Control Imp. on Blue Line	Facility Improve.	●	●	●	●	◗	◗	◗	◗	●
Signal and Train Control Imp. on Green Line	Facility Improve.	❍	❍	❍	❍	❍	❍	❍	❍	❍
Signal and Train Control Imp. on Red Line	Facility Improve.	●	●	●	●	◗	◗	◗	◗	●
Signal and Train Control Imp. on Orange Line	Facility Improve.	●	●	●	●	◗	◗	◗	◗	●
Commonwealth Flats Silver Line Grade Separation	Travel Time Improve.	❍	❍	❍	❍	❍	❍	❍	❍	❍
Preemptive signals on Beacon, Commonwealth, and Huntington	Travel Time Improve.	❍	❍	❍	❍	●	●	●	●	◗

TABLE B-5 RAPID TRANSIT PROJECT EVALUATION – SERVICE QUALITY

Project Description	Type	Safety/ Security	Comfort/ Convenience	Reliability	Inter-. connectivity	Customer Info.	Minimize Transfers	Total
Operate 4-car trains on Green Line	Facility Improve.	❍	❍	❍	❍	❍	❍	❍
Operate 8-car trains on Orange Line	Facility Improve.	❍	❍	❍	❍	❍	❍	❍
Operate 8-car trains on Red Line	Facility Improve.	❍	❍	❍	❍	❍	❍	❍
Signal and Train Control Imp. on Blue Line	Facility Improve.	❍	❍	●	❍	❍	❍	◗
Signal and Train Control Imp. on Green Line	Facility Improve.	◗	❍	●	❍	❍	❍	◗
Signal and Train Control Imp. on Red Line	Facility Improve.	❍	❍	●	❍	❍	❍	◗
Signal and Train Control Imp. on Orange Line	Facility Improve.	❍	❍	●	❍	❍	❍	◗
Commonwealth Flats Silver Line Grade Separation	Travel Time Improve.	❍	❍	●	❍	❍	❍	◗
Preemptive signals on Beacon, Commonwealth, and Huntington	Travel Time Improve.	❍	❍	●	❍	❍	❍	◗

TABLE B-6 RAPID TRANSIT PROJECT EVALUATION – ENVIRONMENTAL JUSTICE

Project Description	Type	Serves Target Neighborhoods	Rectify Barriers	Responds to EJ Issues in RTP	Burdens on Target Neighborhoods	Total
Operate 4-car trains on Green Line	Facility Improvement	◗	❍	❍	●	◗
Operate 8-car trains on Orange Line	Facility Improvement	●	❍	❍	●	●
Operate 8-car trains on Red Line	Facility Improvement	◗	❍	❍	●	◗
Signal and Train Control Imp. on Blue Line	Facility Improvement	●	❍	❍	N/A	◗
Signal and Train Control Imp. on Green Line	Facility Improvement	◗	❍	❍	N/A	❍
Signal and Train Control Imp. on Red Line	Facility Improvement	◗	❍	❍	N/A	❍
Signal and Train Control Imp. on Orange Line	Facility Improvement	●	❍	❍	N/A	◗
Commonwealth Flats Silver Line Grade Separation	Travel Time Improvement	◗	◗	❍	N/A	◗
Preemptive signals on Beacon, Commonwealth, and Huntington	Travel Time Improvement	◗	◗	❍	●	◗

TABLE B-7 RAPID TRANSIT PROJECT EVALUATION – OVERALL

Project Description	Type	Utilization	Mobility	Cost Effective	Air. Quality	Service Quality	Environ. Justice	Total
Operate 4-car trains on Green Line	Facility Improve.	◗	❍	❍	❍	❍	◗	❍
Operate 8-car trains on Orange Line	Facility Improve.	◗	❍	◗	◗	❍	●	◗
Operate 8-car trains on Red Line	Facility Improve.	◗	❍	◗	◗	❍	◗	◗
Signal and Train Control Imp. on Blue Line	Facility Improve.	●	❍	●	●	◗	◗	●
Signal and Train Control Imp. on Green Line	Facility Improve.	❍	❍	❍	❍	◗	❍	❍
Signal and Train Control Imp. on Red Line	Facility Improve.	●	❍	◗	●	◗	❍	●
Signal and Train Control Imp. on Orange Line	Facility Improve.	●	❍	●	●	◗	◗	●
Commonwealth Flats Silver Line Grade Separation	Travel Time Improve.	❍	❍	❍	❍	❍	◗	❍
Preemptive signals on Beacon, Commonwealth, and Huntington	Travel Time Improve.	❍	❍	●	◗	❍	◗	◗

TABLE B-8 BUS/TRACKLESS TROLLEY PROJECT EVALUATION – UTILIZATION

Project Description	Type	Ridership	New Riders	Impact on Mode Share	Reduct. in Crowd-ing	Reduct. in VMT	Travel Time Savings	Total
Install automatic passenger counters on buses	Facility Improvement	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Install 300 shelters	Facility Improvement	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Add exclusive lanes and priority signals along the top ten highest ridership bus routes.	Travel Time Improvement	◗	❍	◗	❍	◗	◗	◗
Install Intelligent Transportation System(ITS) systems for bus fleet	Travel Time Improvement	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Purchase 100 new buses	Frequency Improvement	●	◗	◗	◗	◗	●	●

TABLE B-9 BUS/TRACKLESS TROLLEY PROJECT EVALUATION – MOBILITY

Project Description	Type	Service to Areas with Unmet Demand	Service During Time with Unmet Demand	Service to Underserved Employment Centers	Total
Install automatic passenger counters on buses	Facility Improvement	❍	❍	❍	❍
Install 300 shelters	Facility Improvement	❍	❍	❍	❍
Add exclusive lanes and priority signals along the top ten highest ridership bus routes.	Travel Time Improvement	❍	❍	❍	❍
Install Intelligent Transportation System (ITS) systems for bus fleet	Travel Time Improvement	❍	❍	❍	❍
Purchase 100 new buses	Frequency Improvement	❍	❍	❍	❍

TABLE B-10 BUS/TRACKLESS TROLLEY PROJECT EVALUATION – COST EFFECTIVENESS						
Project Description	**Type**	**Capital Cost Per New Transit Rider**	**Net Operating Costs Per New Transit Rider**	**Capital Cost Per Unit Travel Time Savings**	**Net Operating Costs Per Unit Travel Time Savings**	**Total**
Install automatic passenger counters on buses	Facility Improvement	N/A	N/A	N/A	N/A	N/A
Install 300 shelters	Facility Improvement	N/A	N/A	N/A	N/A	N/A
Add exclusive lanes and priority signals along the top ten highest ridership bus routes.	Travel Time Improvement	❍	N/A	◗	N/A	❍
Install Intelligent Transportation System (ITS) systems for bus fleet	Travel Time Improvement	N/A	N/A	N/A	N/A	N/A
Purchase 100 new buses	Frequency Improvement	◗	❍	●	●	◗

TABLE B-11 BUS/TRACKLESS TROLLEY PROJECT EVALUATION – AIR QUALITY

Project Description	Type	Reduct. in VOC	Reduct. in NOx	Reduct. in CO	Reduct. in CO_2	Capital Cost Per Reduct. in VOC	Capital Cost Per Reduct. in NOx	Capital Cost Per Reduct. in CO	Capital Cost Per Reduct. in CO_2	Total
Install automatic passenger counters on buses	Facility Improve.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Install 300 shelters	Facility Improve.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Add exclusive lanes and priority signals along the top ten highest ridership bus routes.	Travel Time Improve.	◗	●	◗	◗	◗	◗	◗	◗	◗
Install Intelligent Transportation System (ITS) systems for bus fleet	Travel Time Improve.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Purchase 100 new buses	Frequency Improve.	❍	❍	❍	❍	❍	❍	❍	❍	❍

TABLE B-12 BUS/TRACKLESS TROLLEY PROJECT EVALUATION – SERVICE QUALITY

Project Description	Type	Safety/ Security	Comfort/ Convience	Reliability	Inter connectivity	Customer Informa-tion	Minimize Transfers	Total
Install automatic passenger counters on buses	Facility Improvement	❍	❍	◗	❍	❍	❍	❍
Install 300 shelters	Facility Improvement	◗	●	❍	❍	◗	❍	◗
Add exclusive lanes and priority signals along the top ten highest ridership bus routes.	Travel Time Improvement	❍	◗	●	❍	❍	❍	◗
Install Intelligent Transportation System (ITS) systems for bus fleet	Travel Time Improvement	●	❍	●	❍	●	❍	●
Purchase 100 new buses	Frequency Improvement	❍	❍	❍	❍	❍	❍	❍

TABLE B-13 BUS/TRACKLESS TROLLEY PROJECT EVALUATION – ENVIRONMENTAL JUSTICE

Project Description	Type	Serves Target Neighbor-hoods	Rectify Barriers	Responds to EJ Issues in RTP	Avoids Burdens Without Benefits	Total
Install automatic passenger counters on buses	Facility Improvement	❍	❍	❍	N/A	❍
Install 300 shelters	Facility Improvement	●	◗	●	●	●
Add exclusive lanes and priority signals along the top ten highest ridership bus routes.	Travel Time Improvement	●	❍	●	●	●
Install Intelligent Transportation System (ITS) systems for bus fleet	Travel Time Improvement	◗	❍	◗	●	◗
Purchase 100 new buses	Frequency Improvement	●	❍	●	●	●

TABLE B-14 BUS/TRACKLESS TROLLEY PROJECT EVALUATION – OVERALL

Project Description	Type	Utilization	Mobility	Cost Effective	Air. Quality	Service Quality	Environ. Justice	Total
Install automatic passenger counters on buses	Facility Improvement	N/A	❍	N/A	N/A	❍	❍	❍
Install 300 shelters	Facility Improvement	N/A	❍	N/A	N/A	◗	●	●
Add exclusive lanes and priority signals along the top ten highest ridership bus routes.	Travel Time Improvement	◗	❍	❍	◗	◗	●	◗
Install Intelligent Transportation System(ITS) systems for bus fleet	Travel Time Improvement	N/A	❍	N/A	N/A	●	◗	●
Purchase 100 new buses	Frequency Improvement	●	❍	◗	❍	❍	●	◗

TABLE B-15 COMMUTER RAIL PROJECT EVALUATION – UTILIZATION

Project Description	Type	Ridership	New Riders	Impact on Mode Share	Reduct. in Crowding	Reduct. in VMT	Travel Time Savings	Total
Add bike racks to coaches	Facility Improvement	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Expand the waiting area at North Station	Facility Improvement	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Improve pedestrian access to Anderson RTC from western side of tracks	Facility Improvement	❍	❍	❍	❍	❍	❍	❍
Install welded rail along sections of Haverhill, Lowell, and Fitchburg lines where it is not presently in place	Facility Improvement	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Upgrade station signage for commuter rail systemwide	Facility Improvement	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Increase speed and frequency of Needham service	Freq/Trav. Time Improv.	◗	◗	◗	❍	◗	◗	◗
Build new layover facility in Bellingham for the Franklin Line	Frequency Improvement	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Expand Reverse Commuting Options	Frequency Improvement	●	●	❍	❍	●	●	●
Install a fourth track on the Fort Point Channel Bridge	Frequency Improvement	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Install double-tracking on entire commuter rail system	Frequency Improvement	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Install platforms on both sides of tracks at stations in Newton so that reverse commuting trips may make more stops.	Frequency Improvement	❍	❍	❍	❍	❍	❍	❍
Operate a Yawkey-Back Bay-South Station shuttle	Frequency Improvement	◗	◗	❍	◗	◗	❍	◗
Operate more frequent service between Framingham and Worcester	Frequency Improvement	◗	◗	❍	◗	◗	◗	◗
Purchase diesel multiple unit trains to allow for increased frequency on commuter rail lines	Frequency Improvement	◗	◗	◗	❍	◗	◗	◗
Construct high platforms at all Providence Line stations not so equipped and expand to other lines at a later date	Travel Time Improvement	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Electrify all commuter rail lines	Travel Time Improvement	◗	◗	◗	◗	◗	◗	◗
Operate express service from outer stations	Travel Time Improvement	●	●	●	●	●	●	●

TABLE B-16 COMMUTER RAIL PROJECT EVALUATION – MOBILITY

Project Description	Type	Service to Areas with Unmet Demand	Service During Time with Unmet Demand	Service to Underserved Employment Centers	Total
Add bike racks to coaches	Facility Improvement	❍	❍	❍	❍
Expand the waiting area at North Station	Facility Improvement	❍	❍	❍	❍
Improve pedestrian access to Anderson RTC from western side of tracks	Facility Improvement	◗	❍	❍	◗
Install welded rail along sections of Haverhill, Lowell, and Fitchburg lines where it is not presently in place	Facility Improvement	❍	❍	❍	❍
Upgrade station signage for commuter rail systemwide	Facility Improvement	❍	❍	❍	❍
Increase speed and frequency of Needham service	Freq/Trav. Time Improv.	❍	❍	❍	❍
Build new layover facility in Bellingham for the Franklin Line	Frequency Improvement	❍	❍	❍	❍
Expand Reverse Commuting Options	Frequency Improvement	❍	●	●	●
Install a fourth track on the Fort Point Channel Bridge	Frequency Improvement	❍	❍	❍	❍
Install double-tracking on entire commuter rail system	Frequency Improvement	❍	❍	❍	❍
Install platforms on both sides of tracks at stations in Newton so that reverse commuting trips may make more stops.	Frequency Improvement	❍	❍	❍	❍
Operate a Yawkey-Back Bay-South Station shuttle	Frequency Improvement	❍	❍	◗	◗
Operate more frequent service between Framingham and Worcester	Frequency Improvement	❍	◗	❍	◗
Purchase diesel multiple unit trains to allow for increased frequency on commuter rail lines	Frequency Improvement	❍	●	❍	●
Construct high platforms at all Providence Line stations not so equipped and expand to other lines at a later date	Travel Time Improvement	❍	❍	❍	❍
Electrify all commuter rail lines	Travel Time Improvement	❍	❍	❍	❍
Operate express service from outer stations	Travel Time Improvement	❍	❍	❍	❍

TABLE B-17 COMMUTER RAIL PROJECT EVALUATION – COST EFFECTIVENESS

Project Description	Type	Capital Cost Per New Transit Rider	Net Operating Costs Per New Transit Rider	Capital Cost Per Unit Travel Time Savings	Net Operating Costs Per Unit Travel Time Savings	Total
Add bike racks to coaches	Facility Improvement	N/A	N/A	N/A	N/A	N/A
Expand the waiting area at North Station	Facility Improvement	N/A	N/A	N/A	N/A	N/A
Improve pedestrian access to Anderson RTC from western side of tracks	Facility Improvement	●	N/A	◗	N/A	●
Install welded rail along sections of Haverhill, Lowell, and Fitchburg lines where it is not presently in place	Facility Improvement	N/A	N/A	N/A	N/A	N/A
Upgrade station signage for commuter rail systemwide	Facility Improvement	N/A	N/A	N/A	N/A	N/A
Increase speed and frequency of Needham service	Freq/Trav. Time Improv.	◗	❍	◗	❍	❍
Build new layover facility in Bellingham for the Franklin Line	Frequency Improvement	N/A	N/A	N/A	N/A	N/A
Expand Reverse Commuting Options	Frequency Improvement	●	◗	●	◗	◗
Install a fourth track on the Fort Point Channel Bridge	Frequency Improvement	N/A	N/A	N/A	N/A	N/A
Install double-tracking on entire commuter rail system	Frequency Improvement	N/A	N/A	N/A	N/A	N/A
Install platforms on both sides of tracks at stations in Newton so that reverse commuting trips may make more stops.	Frequency Improvement	❍	N/A	❍	N/A	❍
Operate a Yawkey-Back Bay-South Station shuttle	Frequency Improvement	●	●	◗	❍	◗
Operate more frequent service between Framingham and Worcester	Frequency Improvement	N/A	●	N/A	●	●
Purchase diesel multiple unit trains to allow for increased frequency on commuter rail lines	Frequency Improvement	❍	❍	❍	◗	❍
Construct high platforms at all Providence Line stations not so equipped and expand to other lines at a later date	Travel Time Improvement	N/A	N/A	N/A	N/A	N/A
Electrify all commuter rail lines	Travel Time Improvement	❍	N/A	❍	N/A	❍
Operate express service from outer stations	Travel Time Improvement	●	◗	●	●	●

TABLE B-18 COMMUTER RAIL PROJECT EVALUATION – AIR QUALITY

Project Description	Type	Reduct. in VOC	Reduct. in NOx	Reduct. in CO	Reduct. in CO_2	Capital Cost Per Reduct. in VOC	Capital Cost Per Reduct. in NOx	Capital Cost Per Reduct. in CO	Capital Cost Per Reduct. in CO_2	Total
Add bike racks to coaches	Facility Improve.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Expand the waiting area at North Station	Facility Improve.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Improve pedestrian access to Anderson RTC from western side of tracks	Facility Improve.	❍	❍	◗	◗	●	●	●	●	◗
Install welded rail along sections of Haverhill, Lowell, and Fitchburg lines where it is not presently in place	Facility Improve.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Upgrade station signage for commuter rail systemwide	Facility Improve.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Increase speed and frequency of Needham service	Freq/Trav. Time Improv.	❍	❍	◗	◗	❍	❍	◗	●	❍
Build new layover facility in Bellingham for the Franklin Line	Frequency Improve.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Expand Reverse Commuting Options	Frequency Improve.	◗	❍	●	●	◗	❍	●	●	◗
Install a fourth track on the Fort Point Channel Bridge	Frequency Improve.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Install double-tracking on entire commuter rail system	Frequency Improve.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Install platforms on both sides of tracks at stations in Newton so that reverse commuting trips may make more stops.	Frequency Improve.	❍	❍	◗	◗	◗	◗	◗	◗	◗
Operate a Yawkey-Back Bay-South Station shuttle	Frequency Improve.	◗	❍	◗	◗	●	❍	●	●	◗
Operate more frequent service between Framingham and Worcester	Frequency Improvement	◗	❍	●	◗					◗
Purchase diesel multiple unit trains to allow for increased frequency on commuter rail lines	Frequency Improve.	❍	❍	❍	❍	❍	❍	❍	❍	❍
Construct high platforms at all Providence Line stations not so equipped and expand to other lines at a later date	Travel Time Improve.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Electrify all commuter rail lines	Travel Time Improve.	●	●	●	●	●	●	◗	◗	●
Operate express service from outer stations	Travel Time Improve.	◗	❍	●	●	◗	❍	●	●	◗

TABLE B-19 COMMUTER RAIL PROJECT EVALUATION – SERVICE QUALITY

Project Description	Type	Safety/ Security	Comfort/ Convenience	Reliability	Inter connectivity	Customer Info.	Minimize Transfers	Total
Add bike racks to coaches	Facility Improvement	❍	◗	❍	●	❍	❍	◗
Expand the waiting area at North Station	Facility Improvement	❍	●	❍	❍	◗	❍	◗
Improve pedestrian access to Anderson RTC from western side of tracks	Facility Improvement	◗	◗	❍	●	❍	❍	◗
Install welded rail along sections of Haverhill, Lowell, and Fitchburg lines where it is not presently in place	Facility Improvement	❍	◗	◗	❍	❍	❍	◗
Upgrade station signage for commuter rail systemwide	Facility Improvement	❍	❍	❍	❍	●	❍	◗
Increase speed and frequency of Needham service	Freq/Trav. Time Improv.	❍	❍	❍	❍	❍	◗	❍
Build new layover facility in Bellingham for the Franklin Line	Frequency Improvement	❍	❍	❍	❍	❍	❍	❍
Expand Reverse Commuting Options	Frequency Improvement	❍	❍	❍	❍	❍	●	◗
Install a fourth track on the Fort Point Channel Bridge	Frequency Improvement	❍	❍	●	❍	❍	❍	◗
Install double-tracking on entire commuter rail system	Frequency Improvement	❍	❍	●	❍	❍	❍	◗
Install platforms on both sides of tracks at stations in Newton so that reverse commuting trips may make more stops.	Frequency Improvement	❍	❍	❍	❍	❍	❍	❍
Operate a Yawkey-Back Bay-South Station shuttle	Frequency Improvement	❍	❍	❍	❍	❍	●	◗
Operate more frequent service between Framingham and Worcester	Frequency Improvement	❍	❍	❍	❍	❍	❍	❍
Purchase diesel multiple unit trains to allow for increased frequency on commuter rail lines	Frequency Improvement	❍	❍	❍	❍	❍	❍	❍
Construct high platforms at all Providence Line stations not so equipped and expand to other lines at a later date	Travel Time Improvement	❍	◗	❍	❍	❍	❍	❍
Electrify all commuter rail lines	Travel Time Improvement	❍	❍	❍	❍	❍	❍	❍
Operate express service from outer stations	Travel Time Improvement	❍	❍	❍	❍	❍	❍	❍

TABLE B-20 COMMUTER RAIL PROJECT EVALUATION – ENVIRONMENTAL JUSTICE

Project Description	Type	Serves Target Neighborhds	Rectify Barriers	Responds to EJ Issues in RTP	Avoids Burdens Without Benefits	Total
Add bike racks to coaches	Facility Improvement	N/A	❍	❍	N/A	❍
Expand the waiting area at North Station	Facility Improvement	◗	❍	❍	N/A	❍
Improve pedestrian access to Anderson RTC from western side of tracks	Facility Improvement	❍	◗	❍	N/A	❍
Install welded rail along sections of Haverhill, Lowell, and Fitchburg lines where it is not presently in place	Facility Improvement	◗	❍	❍	●	◗
Upgrade station signage for commuter rail systemwide	Facility Improvement	◗	❍	❍	●	◗
Increase speed and frequency of Needham service	Freq/Trav. Time Improv.	❍	❍	❍	N/A	❍
Build new layover facility in Bellingham for the Franklin Line	Frequency Improvement	❍	◗	❍	N/A	❍
Expand Reverse Commuting Options	Frequency Improvement	◗	◗	❍	N/A	◗
Install a fourth track on the Fort Point Channel Bridge	Frequency Improvement	◗	◗	❍	●	●
Install double-tracking on entire commuter rail system	Frequency Improvement	◗	◗	❍	N/A	◗
Install platforms on both sides of tracks at stations in Newton so that reverse commuting trips may make more stops.	Frequency Improvement	❍	◗	❍	N/A	❍
Operate a Yawkey-Back Bay-South Station shuttle	Frequency Improvement	◗	◗	❍	●	●
Operate more frequent service between Framingham and Worcester	Frequency Improvement	◗	◗	❍	●	●
Purchase diesel multiple unit trains to allow for increased frequency on commuter rail lines	Frequency Improvement	◗	◗	❍	N/A	◗
Construct high platforms at all Providence Line stations not so equipped and expand to other lines at a later date	Travel Time Improvement	❍	❍	❍	N/A	❍
Electrify all commuter rail lines	Travel Time Improvement	◗	❍	❍	N/A	❍
Operate express service from outer stations	Travel Time Improvement	◗	❍	❍	N/A	❍

TABLE B-21 COMMUTER RAIL PROJECT EVALUATION – OVERALL

Project Description	Type	Utilization	Mobility	Cost Effective	Air. Quality	Service Quality	Environ. Justice	Total
Add bike racks to coaches	Facility Improvement	N/A	❍	N/A	N/A	◗	❍	❍
Expand the waiting area at North Station	Facility Improvement	N/A	❍	N/A	N/A	◗	❍	❍
Improve pedestrian access to Anderson RTC from western side of tracks	Facility Improvement	❍	◗	●	◗	◗	❍	◗
Install welded rail along sections of Haverhill, Lowell, and Fitchburg lines where it is not presently in place	Facility Improvement	N/A	❍	N/A	N/A	◗	◗	◗
Upgrade station signage for commuter rail systemwide	Facility Improvement	N/A	❍	N/A	N/A	◗	◗	◗
Increase speed and frequency of Needham service	Freq/Trav. Time Improv.	◗	❍	❍	❍	❍	❍	❍
Build new layover facility in Bellingham for the Franklin Line	Frequency Improvement	N/A	❍	N/A	N/A	❍	❍	❍
Expand Reverse Commuting Options	Frequency Improvement	●	●	◗	◗	◗	◗	●
Install a fourth track on the Fort Point Channel Bridge	Frequency Improvement	N/A	❍	N/A	N/A	◗	●	◗
Install double-tracking on entire commuter rail system	Frequency Improvement	N/A	❍	N/A	N/A	◗	◗	◗
Install platforms on both sides of tracks at stations in Newton so that reverse commuting trips may make more stops.	Frequency Improvement	❍	❍	❍	◗	❍	❍	❍
Operate a Yawkey-Back Bay-South Station shuttle	Frequency Improvement	◗	◗	◗	◗	◗	●	●
Operate more frequent service between Framingham and Worcester	Frequency Improvement	◗	◗	●	◗	❍	●	●
Purchase diesel multiple unit trains to allow for increased frequency on commuter rail lines	Frequency Improvement	◗	●	❍	❍	❍	◗	❍
Construct high platforms at all Providence Line stations not so equipped and expand to other lines at a later date	Travel Time Improvement	N/A	❍	N/A	N/A	❍	❍	❍
Electrify all commuter rail lines	Travel Time Improvement	◗	❍	❍	●	❍	❍	❍
Operate express service from outer stations	Travel Time Improvement	●	❍	●	◗	❍	❍	◗

TABLE B-22 SYSTEMWIDE PROJECT EVALUATION – UTILIZATION

Project Description	Type	Ridership	New Riders	Impact on Mode Share	Reduct. in Crowd-ing	Reduct. in VMT	Travel Time Savings	Total
Add bike racks to coaches	Access Improvement	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Add more motorcycle parking spaces systemwide	Access Improvement	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Improve pedestrian access to all rapid transit and commuter rail stations	Access Improvement	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Improve pedestrian access to Anderson RTC from western side of tracks	Access Improvement	❍	❍	❍	❍	❍	❍	❍
Install bike racks at rapid transit and commuter rail stations	Access Improvement	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Install more enclosed waiting areas along MBTA lines	Access Improvement	N/A	N/A	N/A	N/A	N/A	N/A	N/A

TABLE B-23 SYSTEMWIDE PROJECT EVALUATION – MOBILITY

Project Description	Type	Service to Areas with Unmet Demand	Service During Time with Unmet Demand	Service to Underserved Employment Centers	Total
Add bike racks to coaches	Access Improvement	❍	❍	❍	❍
Add more motorcycle parking spaces systemwide	Access Improvement	❍	❍	❍	❍
Improve pedestrian access to all rapid transit and commuter rail stations	Access Improvement	❍	❍	❍	❍
Improve pedestrian access to Anderson RTC from western side of tracks	Access Improvement	◗	❍	❍	◗
Install bike racks at rapid transit and commuter rail stations	Access Improvement	❍	❍	❍	❍
Install more enclosed waiting areas along MBTA lines	Access Improvement	❍	❍	❍	❍

TABLE B-24 SYSTEMWIDE PROJECT EVALUATION – COST EFFECTIVENESS

Project Description	Type	Capital Cost Per New Transit Rider	Net Operating Costs Per New Transit Rider	Capital Cost Per Unit Travel Time Savings	Net Operating Costs Per Unit Travel Time Savings	Total
Add bike racks to coaches	Access Improvement	N/A	N/A	N/A	N/A	N/A
Add more motorcycle parking spaces systemwide	Access Improvement	N/A	N/A	N/A	N/A	N/A
Improve pedestrian access to all rapid transit and commuter rail stations	Access Improvement	N/A	N/A	N/A	N/A	N/A
Improve pedestrian access to Anderson RTC from western side of tracks	Access Improvement	●	N/A	◗	N/A	●
Install bike racks at rapid transit and commuter rail stations	Access Improvement	N/A	N/A	N/A	N/A	N/A
Install more enclosed waiting areas along MBTA lines	Access Improvement	N/A	N/A	N/A	N/A	N/A

TABLE B-25 SYSTEMWIDE PROJECT EVALUATION – AIR QUALITY

Project Description	Type	Reduct. in VOC	Reduct. in NOx	Reduct. in CO	Reduct. in CO_2	Capital Cost Per Reduct. in VOC	Capital Cost Per Reduct. in NOx	Capital Cost Per Reduct. in CO	Capital Cost Per Reduct. in CO_2	Total
Add bike racks to coaches	Access Improve.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Add more motorcycle parking spaces systemwide	Access Improve.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Improve pedestrian access to all rapid transit and commuter rail stations	Access Improve.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Improve pedestrian access to Anderson RTC from western side of tracks	Access Improve.	❍	❍	◗	◗	◗	◗	●	●	◗
Install bike racks at rapid transit and commuter rail stations	Access Improve.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Install more enclosed waiting areas along MBTA lines	Access Improve.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

TABLE B-26 SYSTEMWIDE PROJECT EVALUATION – SERVICE QUALITY

Project Description	Type	Safety/ Security	Comfort/ Convenience	Reliability	Inter connectivity	Customer Informa-tion	Minimize Transfers	Total
Add bike racks to coaches	Access Improvement	❍	◗	❍	●	❍	❍	◗
Add more motorcycle parking spaces systemwide	Access Improvement	❍	◗	❍	◗	❍	❍	❍
Improve pedestrian access to all rapid transit and commuter rail stations	Access Improvement	◗	◗	❍	●	❍	❍	●
Improve pedestrian access to Anderson RTC from western side of tracks	Access Improvement	◗	◗	❍	●	❍	❍	●
Install bike racks at rapid transit and commuter rail stations	Access Improvement	❍	◗	❍	●	❍	❍	◗
Install more enclosed waiting areas along MBTA lines	Access Improvement	◗	●	❍	❍	◗	❍	●

TABLE B-27 SYSTEMWIDE PROJECT EVALUATION – ENVIRONMENTAL JUSTICE

Project Description	Type	Serves Target Neighbor-hoods	Rectify Barriers	Responds to EJ Issues in RTP	Avoids Burdens Without Benefits	Total
Add bike racks to coaches	Access Improvement	N/A	❍	❍	N/A	❍
Add more motorcycle parking spaces systemwide	Access Improvement	◗	❍	❍	●	◗
Improve pedestrian access to all rapid transit and commuter rail stations	Access Improvement	◗	◗	❍	●	●
Improve pedestrian access to Anderson RTC from western side of tracks	Access Improvement	❍	◗	❍	●	◗
Install bike racks at rapid transit and commuter rail stations	Access Improvement	◗	◗	❍	●	●
Install more enclosed waiting areas along MBTA lines	Access Improvement	◗	❍	❍	●	◗

TABLE B-28 SYSTEMWIDE PROJECT EVALUATION – OVERALL

Project Description	Type	Utilization	Mobility	Cost Effective	Air. Quality	Service Quality	Environ. Justice	Total
Add bike racks to coaches	Access Improvement	N/A	❍	N/A	N/A	◗	❍	❍
Add more motorcycle parking spaces systemwide	Access Improvement	N/A	❍	N/A	N/A	❍	◗	❍
Improve pedestrian access to all rapid transit and commuter rail stations	Access Improvement	N/A	❍	N/A	N/A	●	●	●
Improve pedestrian access to Anderson RTC from western side of tracks	Access Improvement	❍	◗	●	◗	●	◗	◗
Install bike racks at rapid transit and commuter rail stations	Access Improvement	N/A	❍	N/A	N/A	◗	●	◗
Install more enclosed waiting areas along MBTA lines	Access Improvement	N/A	❍	N/A	N/A	●	◗	◗

System Expansion Project Evaluation Ratings

TABLE B-29 RAPID TRANSIT PROJECT EVALUATION – UTILIZATION

Project Description	Type	Ridership	New Riders	Impact on Mode Share	Reduct. in Crowd.	Reduct. in VMT	Travel Time Savings	Total
Blue-Red Connector	Line Extension	❍	◗	◗	◗	◗	●	◗
Convert Dudley-Boylston section of Silver Line to light rail	Line Extension	●	❍	❍	❍	❍	◗	❍
Extend Blue Line from Bowdoin to West Medford	Line Extension	◗	◗	◗	❍	◗	●	◗
Extend Blue Line from Lynn to Salem	Line Extension	◗	●	●	❍	●	◗	●
Extend Blue Line from Wonderland to Lynn	Line Extension	◗	●	◗	❍	●	●	●
Extend Green Line to West Medford	Line Extension	◗	◗	◗	❍	◗	●	◗
New Green Line Needham Branch	Line Extension	❍	❍	❍	❍	❍	❍	❍
Orange Line No. Ext. From Oak Grove to Reading/Route 128	Line Extension	◗	◗	◗	❍	◗	●	◗
Orange Line So. Ext. From Forest Hills to Rt 128 Via Hyde Park	Line Extension	❍	❍	❍	❍	◗	◗	❍
Orange Line So. Ext. From Forest Hills to W. Roxbury/Needham	Line Extension	◗	❍	❍	❍	❍	❍	❍
Red Line extension to Weymouth	Line Extension	❍	◗	◗	◗	◗	◗	◗
Red Line NW Ext. from Alewife to Rt 128	Line Extension	❍	❍	❍	❍	◗	●	❍
Restore Green Line service between Heath St & Arborway	Line Extension	◗	❍	❍	❍	❍	❍	❍
Silver Line East Ext. to City Point	Line Extension	❍	❍	❍	◗	◗	❍	❍
Silver Line Phase III: South Station-Boylston Connector	Line Extension	◗	◗	◗	◗	◗	●	●
Silver Line So. Ext. to Ashmont & Mattapan	Line Extension	●	❍	❍	◗	❍	◗	◗
Silver Line West Exts. to Allston & Longwood Medical Area	Line Extension	●	●	●	◗	◗	●	●
Urban Ring Phase II	Line Extension	●	●	◗	●	●	●	●
Urban Ring Phase III	Line Extension	●	●	●	●	●	●	●
Construct Orange Line station at Assembly Sq	New Station	❍	❍	◗	❍	❍	◗	❍
Wonderland Connector	New Station	❍	❍	◗	❍	❍	❍	❍

TABLE B-30 RAPID TRANSIT PROJECT EVALUATION – MOBILITY

Project Description	Type	Service to Areas With Unmet Demand	Service During Time Periods With Unmet Demand	Service to Underserved Employment Centers	Total
Blue-Red Connector	Line Extension	●	❍	❍	◗
Convert Dudley-Boylston section of Silver Line to light rail	Line Extension	◗	❍	❍	❍
Extend Blue Line from Bowdoin to West Medford	Line Extension	●	❍	❍	◗
Extend Blue Line from Lynn to Salem	Line Extension	◗	❍	◗	◗
Extend Blue Line from Wonderland to Lynn	Line Extension	◗	❍	◗	◗
Extend Green Line to West Medford	Line Extension	●	❍	❍	◗
New Green Line Needham Branch	Line Extension	◗	❍	❍	❍
Orange Line No. Ext. From Oak Grove to Reading/Route 128	Line Extension	◗	❍	❍	❍
Orange Line So. Ext. From Forest Hills to Rt 128 Via Hyde Park	Line Extension	◗	❍	❍	❍
Orange Line So. Ext. From Forest Hills to W. Roxbury/Needham	Line Extension	◗	❍	❍	❍
Red Line extension to Weymouth	Line Extension	◗	❍	❍	❍
Red Line NW Ext. from Alewife to Rt 128	Line Extension	◗	❍	❍	❍
Restore Green Line service between Heath St & Arborway	Line Extension	◗	❍	❍	❍
Silver Line East Ext. to City Point	Line Extension	❍	❍	❍	❍
Silver Line Phase III: South Station-Boylston Connector	Line Extension	●	❍	●	●
Silver Line So. Ext. to Ashmont & Mattapan	Line Extension	●	❍	❍	◗
Silver Line West Exts. to Allston & Longwood Medical Area	Line Extension	●	❍	❍	◗
Urban Ring Phase II	Line Extension	●	❍	●	●
Urban Ring Phase III	Line Extension	●	❍	●	●
Construct Orange Line station at Assembly Sq	New Station	◗	❍	❍	❍
Wonderland Connector	New Station	◗	❍	❍	❍

TABLE B-31 RAPID TRANSIT PROJECT EVALUATION – COST EFFECTIVENESS

Project Description	Type	Capital Cost Per New Transit Rider	Operating Cost Per New Transit Rider	Capital Cost Per Unit Travel Time Savings	Operating Per Unit Travel Time Savings	Total
Blue-Red Connector	Line Extension	●	●	●	●	●
Convert Dudley-Boylston section of Silver Line to light rail	Line Extension	❍	❍	◗	●	❍
Extend Blue Line from Bowdoin to West Medford	Line Extension	◗	◗	◗	◗	◗
Extend Blue Line from Lynn to Salem	Line Extension	●	◗	◗	❍	◗
Extend Blue Line from Wonderland to Lynn	Line Extension	●	◗	◗	❍	◗
Extend Green Line to West Medford	Line Extension	◗	◗	●	◗	◗
New Green Line Needham Branch	Line Extension	◗	❍	❍	❍	❍
Orange Line No. Ext. From Oak Grove to Reading/Route 128	Line Extension	◗	◗	◗	❍	❍
Orange Line So. Ext. From Forest Hills to Rt 128 Via Hyde Park	Line Extension	◗	❍	◗	❍	❍
Orange Line So. Ext. From Forest Hills to W. Roxbury/Needham	Line Extension	❍	❍	❍	❍	❍
Red Line extension to Weymouth	Line Extension	◗	◗	◗	❍	❍
Red Line NW Ext. from Alewife to Rt 128	Line Extension	❍	❍	◗	❍	❍
Restore Green Line service between Heath St & Arborway	Line Extension	❍	●	❍	●	◗
Silver Line East Ext. to City Point	Line Extension	●	●	●	◗	●
Silver Line Phase III: South Station-Boylston Connector	Line Extension	◗	●	◗	●	◗
Silver Line So. Ext. to Ashmont & Mattapan	Line Extension	●	●	●	●	●
Silver Line West Exts. to Allston & Longwood Medical Area	Line Extension	●	●	◗	◗	◗
Urban Ring Phase II	Line Extension	●	◗	●	●	●
Urban Ring Phase III	Line Extension	●	●	●	●	●
Construct Orange Line station at Assembly Sq	New Station	●	N/A	●	N/A	●
Wonderland Connector	New Station	◗	N/A	◗	N/A	◗

TABLE B-32 RAPID TRANSIT PROJECT EVALUATION – AIR QUALITY

Project Description	Type	Reduct. in VOC	Reduct. in NOx	Reduct. in CO	Reduct. in CO_2	Capital Cost Per Reduct. in VOC	Capital Cost Per Reduct. in NOx	Capital Cost Per Reduct. in CO	Capital Cost Per Reduct. in CO_2	Total
Blue-Red Connector	Line Extension	◗	◗	◗	◗	●	●	●	●	◗
Convert Dudley-Boylston section of Silver Line to light rail	Line Extension	❍	❍	❍	❍	❍	❍	❍	❍	❍
Extend Blue Line from Bowdoin to West Medford	Line Extension	◗	◗	◗	◗	◗	◗	◗	◗	◗
Extend Blue Line from Lynn to Salem	Line Extension	●	●	●	●	●	●	●	●	●
Extend Blue Line from Wonderland to Lynn	Line Extension	●	●	●	●	●	●	●	●	●
Extend Green Line to West Medford	Line Extension	◗	◗	◗	◗	◗	◗	◗	◗	◗
New Green Line Needham Branch	Line Extension	❍	❍	❍	❍	◗	◗	◗	◗	❍
Orange Line No. Ext. From Oak Grove to Reading/Route 128	Line Extension	◗	◗	◗	◗	●	●	●	●	◗
Orange Line So. Ext. From Forest Hills to Rt 128 Via Hyde Park	Line Extension	◗	◗	◗	◗	◗	◗	◗	◗	◗
Orange Line So. Ext. From Forest Hills to W. Roxbury/Needham	Line Extension	❍	❍	❍	❍	❍	❍	❍	❍	❍
Red Line extension to Weymouth	Line Extension	◗	◗	◗	◗	●	●	●	●	◗
Red Line NW Ext. from Alewife to Rt 128	Line Extension	◗	◗	◗	◗	◗	◗	◗	◗	◗
Restore Green Line service between Heath St & Arborway	Line Extension	❍	❍	❍	❍	❍	❍	❍	❍	❍
Silver Line East Ext. to City Point	Line Extension	❍	❍	❍	❍	●	●	●	●	◗
Silver Line Phase III: South Station-Boylston Connector	Line Extension	◗	◗	◗	◗	◗	◗	◗	◗	◗
Silver Line So. Ext. to Ashmont & Mattapan	Line Extension	❍	❍	❍	❍	●	●	●	●	◗
Silver Line West Exts. to Allston & Longwood Medical Area	Line Extension	◗	◗	◗	◗	●	●	●	●	◗
Urban Ring Phase II	Line Ext.	●	●	●	●	●	●	●	●	●
Urban Ring Phase III	Line Ext.	●	●	●	●	●	●	●	●	●
Construct Orange Line station at Assembly Sq	New Station	❍	❍	❍	❍	●	●	●	●	◗
Wonderland Connector	New Station	◗	◗	◗	◗	●	●	●	●	◗

TABLE B-33 RAPID TRANSIT PROJECT EVALUATION – SERVICE QUALITY

Project Description	Type	Safety/ Security	Comfort/ Convenience	Reliability	Inter-. connectivity	Customer Info.	Minimize Transfers	Total
Blue-Red Connector	Line Ext.	❍	❍	❍	●	❍	●	◗
Convert Dudley/ Boylston section of Silver Line to light rail	Line Ext.	❍	❍	❍	◗	❍	●	◗
Extend Blue Line from Bowdoin to West Medford	Line Ext.	❍	❍	❍	●	❍	●	◗
Extend Blue Line from Lynn to Salem	Line Ext.	❍	❍	❍	●	❍	●	◗
Extend Blue Line from Wonderland to Lynn	Line Ext.	❍	❍	❍	●	❍	●	◗
Extend Green Line to West Medford	Line Ext.	❍	❍	❍	●	❍	◗	◗
New Green Line Needham Branch	Line Ext.	❍	❍	❍	◗	❍	◗	❍
Orange Line No. Ext. From Oak Grove to Reading/Route 128	Line Ext.	◗	◗	◗	❍	◗	◗	◗
Orange Line So. Ext. From Forest Hills to Rt 128 Via Hyde Park	Line Ext.	❍	❍	❍	◗	❍	●	◗
Orange Line So. Ext. From Forest Hills to W. Roxbury/Needham	Line Ext.	❍	❍	❍	❍	❍	●	❍
Red Line extension to Weymouth	Line Ext.	❍	❍	❍	❍	❍	◗	❍
Red Line NW Ext. from Alewife to Rt 128	Line Ext.	❍	❍	❍	◗	❍	●	◗
Restore Green Line service between Heath St & Arborway	Line Ext.	❍	❍	◗	●	❍	●	●
Silver Line East Ext. to City Point	Line Ext.	❍	❍	◗	❍	◗	◗	◗
Silver Line Phase III: South Station-Boylston Connector	Line Ext.	❍	❍	❍	●	❍	●	◗
Silver Line So. Ext. to Ashmont & Mattapan	Line Ext.	❍	❍	◗	●	◗	●	●
Silver Line West Exts. to Allston & Longwood Medical Area	Line Ext.	❍	❍	◗	❍	◗	◗	◗
Urban Ring Phase II	Line Ext.	❍	❍	◗	●	❍	●	●
Urban Ring Phase III	Line Ext.	❍	❍	●	●	❍	●	●
Construct Orange Line station at Assembly Sq	New Station	❍	❍	❍	❍	❍	◗	❍
Wonderland Connector	New Station	❍	❍	❍	◗	❍	◗	❍

TABLE B-34 RAPID TRANSIT PROJECT EVALUATION – ECONOMIC & LAND USE IMPACTS

Project Description	Type	State Revitalization Area	Local Plans	Regional Plans	Brownfield/ Infill Development	Total
Blue-Red Connector	Line Extension	●	●	●	N/A	●
Convert Dudley-Boylston section of Silver Line to light rail	Line Extension	●	●	●	◗	●
Extend Blue Line from Bowdoin to West Medford	Line Extension	●	◗	●	◗	●
Extend Blue Line from Lynn to Salem	Line Extension	◗	◗	◗	◗	◗
Extend Blue Line from Wonderland to Lynn	Line Extension	●	●	●	◗	●
Extend Green Line to West Medford	Line Extension	◗	◗	●	◗	◗
New Green Line Needham Branch	Line Extension	◗	❍	◗	◗	❍
Orange Line No. Ext. From Oak Grove to Reading/Route 128	Line Extension	❍	◗	◗	◗	❍
Orange Line So. Ext. From Forest Hills to Rt 128 Via Hyde Park	Line Extension	●	❍	●	◗	◗
Orange Line So. Ext. From Forest Hills to W. Roxbury/Needham	Line Extension	◗	❍	◗	◗	❍
Red Line extension to Weymouth	Line Extension	●	❍	●	●	●
Red Line NW Ext. from Alewife to Rt 128	Line Extension	❍	❍	◗	❍	❍
Restore Green Line service between Heath St & Arborway	Line Extension	●	●	●	◗	●
Silver Line East Ext. to City Point	Line Extension	●	◗	●	◗	●
Silver Line Phase III: South Station-Boylston Connector	Line Extension	●	●	●	◗	●
Silver Line So. Ext. to Ashmont & Mattapan	Line Extension	●	◗	●	◗	●
Silver Line West Exts. to Allston & Longwood Medical Area	Line Extension	●	●	●	◗	●
Urban Ring Phase II	Line Extension	●	●	●	●	●
Urban Ring Phase III	Line Extension	●	●	●	●	●
Construct Orange Line station at Assembly Sq	New Station	●	●	●	●	●
Wonderland Connector	New Station	●	❍	●	❍	●

TABLE B-35 RAPID TRANSIT PROJECT EVALUATION – ENVIRONMENTAL JUSTICE

Project Description	Type	Serves Target Neighbrhds	Rectify Barriers	Responds to EJ Issues in RTP	Avoids Burdens Without Benefits	Total
Blue-Red Connector	Line Extension	◗	❍	❍	●	◗
Convert Dudley-Boylston section of Silver Line to light rail	Line Extension	●	◗	◗	●	●
Extend Blue Line from Bowdoin to West Medford	Line Extension	◗	◗	●	●	●
Extend Blue Line from Lynn to Salem	Line Extension	◗	❍	◗	●	◗
Extend Blue Line from Wonderland to Lynn	Line Extension	●	❍	◗	●	●
Extend Green Line to West Medford	Line Extension	◗	◗	●	●	●
New Green Line Needham Branch	Line Extension	❍	❍	❍	●	❍
Orange Line No. Ext. From Oak Grove to Reading/Route 128	Line Extension	❍	❍	❍	●	❍
Orange Line So. Ext. From Forest Hills to Rt 128 Via Hyde Park	Line Extension	◗	❍	❍	●	◗
Orange Line So. Ext. From Forest Hills to W. Roxbury/Needham	Line Extension	◗	❍	❍	●	◗
Red Line extension to Weymouth	Line Extension	◗	❍	❍	●	◗
Red Line NW Ext. from Alewife to Rt 128	Line Extension	❍	❍	❍	●	❍
Restore Green Line service between Heath St & Arborway	Line Extension	❍	❍	❍	●	❍
Silver Line East Ext. to City Point	Line Extension	◗	❍	◗	●	◗
Silver Line Phase III: South Station-Boylston Connector	Line Extension	❍	❍	❍	●	❍
Silver Line So. Ext. to Ashmont & Mattapan	Line Extension	◗	◗	◗	●	●
Silver Line West Exts. to Allston & Longwood Medical Area	Line Extension	◗	❍	❍	●	◗
Urban Ring Phase II	Line Extension	●	❍	◗	●	●
Urban Ring Phase III	Line Extension	●	❍	◗	●	●
Construct Orange Line station at Assembly Sq	New Station	◗	❍	◗	●	◗
Wonderland Connector	New Station	◗	❍	❍	◗	❍

TABLE B-36 RAPID TRANSIT PROJECT EVALUATION – OVERALL

Project Description	Type	Utilization	Mobility	Cost Effective	Air. Quality	Service Quality	Econ/Land Use Impacts	Environ. Justice	Total
Blue-Red Connector	Line Ext.	◗	◗	●	◗	◗	●	◗	◗
Convert Dudley/ Boylston section of Silver Line to light rail	Line Ext.	❍	❍	❍	❍	◗	●	●	❍
Extend Blue Line from Bowdoin to West Medford	Line Ext.	◗	◗	◗	◗	◗	●	●	◗
Extend Blue Line from Lynn to Salem	Line Ext.	●	◗	◗	●	❍	◗	◗	◗
Extend Blue Line from Wonderland to Lynn	Line Ext.	●	◗	◗	●	◗	●	●	●
Extend Green Line to West Medford	Line Ext.	◗	◗	◗	◗	◗	◗	●	◗
New Green Line Needham Branch	Line Ext.	❍	❍	❍	❍	◗	❍	❍	❍
Orange Line No. Ext. From Oak Grove to Reading/Route 128	Line Ext.	◗	❍	❍	◗	❍	❍	❍	❍
Orange Line So. Ext. From Forest Hills to Rt 128 Via Hyde Park	Line Ext.	❍	❍	❍	◗	◗	◗	◗	❍
Orange Line So. Ext. From Forest Hills to W. Roxbury/Needham	Line Ext.	❍	❍	❍	❍	❍	❍	◗	❍
Red Line extension to Weymouth	Line Ext.	◗	❍	❍	◗	❍	●	❍	❍
Red Line NW Ext. from Alewife to Rt 128	Line Ext.	❍	❍	❍	◗	◗	❍	❍	❍
Restore Green Line service between Heath St & Arborway	Line Ext.	❍	❍	◗	❍	●	●	◗	◗
Silver Line East Ext. to City Point	Line Ext.	❍	❍	●	◗	◗	●	❍	◗
Silver Line Phase III: South Station–Boylston Connector	Line Ext.	●	●	◗	◗	◗	●	●	●
Silver Line So. Ext. to Ashmont & Mattapan	Line Ext.	◗	◗	●	◗	●	●	●	●
Silver Line West Exts. to Allston & Longwood Medical Area	Line Ext.	●	◗	◗	◗	◗	●	◗	◗
Urban Ring Phase II	Line Ext.	●	●	●	●	●	●	●	●
Urban Ring Phase III	Line Ext.	●	●	●	●	●	●	●	●
Construct Orange Line station at Assembly Sq	New Station	❍	❍	●	◗	❍	●	◗	◗
Wonderland Connector	New Station	❍	❍	◗	◗	❍	●	❍	❍

TABLE B-37 BUS/TRACKLESS TROLLEY PROJECT EVALUATION – UTILIZATION

Project Description	Type	Ridership	New Riders	Impact on Mode Share	Reduct. in Crowd.	Reduct. in VMT	Travel Time Savings	Total
Build new busways to Alewife Station	Line Ext./ New Line	❍	❍	❍	❍	❍	◗	❍
Extend Trackless Trolley #71 from Watertown to Newton Corner	Line Ext./ New Line	❍	❍	❍	❍	❍	◗	❍
Route 128 Circumferential Bus Service	Line Ext./ New Line	◗	●	●	❍	●	❍	◗
Suburban Commuter Rail Feeder Bus Services	Line Ext./ New Line	◗	◗	◗	◗	◗	◗	◗
Urban Ring Phase I	Line Ext./ New Line	●	●	●	●	●	●	●

TABLE B-38 BUS/TRACKLESS TROLLEY PROJECT EVALUATION – MOBILITY

Project Description	Type	Service to Areas With Unmet Demand	Service During Time Periods With Unmet Demand	Service to Underserved Employment Centers	Total
Build new busways to Alewife Station	Line Extension/ New Line	❍	❍	❍	❍
Extend Trackless Trolley #71 from Watertown to Newton Corner	Line Extension/ New Line	❍	❍	❍	❍
Route 128 Circumferential Bus Service	Line Extension/ New Line	●	❍	●	●
Suburban Commuter Rail Feeder Bus Services	Line Extension/ New Line	●	❍	●	●
Urban Ring Phase I	Line Extension/ New Line	◗	❍	◗	◗

TABLE B-39 BUS/TRACKLESS TROLLEY PROJECT EVALUATION – COST EFFECTIVENESS

Project Description	Type	Capital Cost Per New Transit Rider	Operating Cost Per New Transit Rider	Capital Cost Per Unit Travel Time Savings	Operating Per Unit Travel Time Savings	Total
Build new busways to Alewife Station	Line Extension/ New Line	●	N/A	●	N/A	●
Extend Trackless Trolley #71 from Watertown to Newton Corner	Line Extension/ New Line	◗	●	◗	●	●
Route 128 Circumferential Bus Service	Line Extension/ New Line	◗	◗	❍	❍	❍
Suburban Commuter Rail Feeder Bus Services	Line Extension/ New Line	◗	❍	◗	◗	◗
Urban Ring Phase I	Line Extension/ New Line	❍	❍	◗	◗	❍

TABLE B-40 BUS/TRACKLESS TROLLEY PROJECT EVALUATION – AIR QUALITY

Project Description	Type	Reduct. in VOC	Reduct. in NOx	Reduct. in CO	Reduct. in CO_2	Capital Cost Per Reduct. in VOC	Capital Cost Per Reduct. in NOx	Capital Cost Per Reduct. in CO	Capital Cost Per Reduct. in CO_2	Total
Build new busways to Alewife Station	Line Ext./ New Line	❍	◗	❍	◗	●	●	●	●	●
Extend Trackless Trolley #71 from Watertown to Newton Corner	Line Ext./ New Line	❍	◗	❍	◗	◗	◗	◗	◗	◗
Route 128 Circumferential Bus Service	Line Ext./ New Line	❍	❍	❍	❍	❍	❍	❍	❍	❍
Suburban Commuter Rail Feeder Bus Services	Line Ext./ New Line	◗	❍	◗	◗	◗	❍	◗	◗	◗
Urban Ring Phase I	Line Ext./ New Line	❍	❍	◗	❍	❍	❍	❍	❍	❍

TABLE B-41 BUS/TRACKLESS TROLLEY PROJECT EVALUATION – SERVICE QUALITY

Project Description	Type	Safety/ Security	Comfort/ Convenience	Reliability	Inter-connectivity	Customer Info.	Minimize Transfers	Total
Build new busways to Alewife Station	Line Ext./ New Line	❍	◗	●	❍	❍	❍	◗
Extend Trackless Trolley #71 from Watertown to Newton Corner	Line Ext./ New Line	❍	❍	❍	❍	❍	◗	❍
Route 128 Circumferential Bus Service	Line Ext./ New Line	❍	❍	❍	◗	❍	◗	❍
Suburban Commuter Rail Feeder Bus Services	Line Ext./ New Line	◗	◗	❍	●	❍	❍	●
Urban Ring Phase I	Line Ext./ New Line	❍	◗	❍	◗	❍	●	●

TABLE B-42 BUS/TRACKLESS TROLLEY PROJECT EVALUATION – ENVIRONMENTAL JUSTICE						
Project Description	Type	Serves Target Neighbrhds	Rectify Barriers	Responds to EJ Issues in RTP	Avoids Burdens Without Benefits	Total
Build new busways to Alewife Station	Line Ext./ New Line	❍	❍	❍	N/A	❍
Extend Trackless Trolley #71 from Watertown to Newton Corner	Line Ext./ New Line	❍	❍	❍	N/A	❍
Route 128 Circumferential Bus Service	Line Ext./ New Line	❍	❍	❍	N/A	❍
Suburban Commuter Rail Feeder Bus Services	Line Ext./ New Line	◗	●	◗	●	●
Urban Ring Phase I	Line Ext./ New Line	●	❍	●	●	●

TABLE B-43 BUS/TRACKLESS TROLLEY PROJECT EVALUATION – OVERALL

Project Description	Type	Utilization	Mobility	Cost Effective	Air. Quality	Service Quality	Environ. Justice	Total
Build new busways to Alewife Station	Line Ext./ New Line	❍	❍	●	●	◗	❍	◗
Extend Trackless Trolley #71 from Watertown to Newton Corner	Line Ext./ New Line	❍	❍	●	◗	❍	❍	❍
Route 128 Circumferential Bus Service	Line Ext./ New Line	◗	●	❍	❍	❍	❍	❍
Suburban Commuter Rail Feeder Bus Services	Line Ext./ New Line	◗	●	◗	◗	●	●	●
Urban Ring Phase I	Line Ext./ New Line	●	◗	❍	❍	●	●	●

TABLE B-44 CRR PROJECT EVALUATION – UTILIZATION

Project Description	Type	Ridership	New Riders	Impact on Mode Share	Reduct. in Crowd.	Reduct. in VMT	Travel Time Savings	Total
Build CRR spur from Framingham to Leominster	Line Ext.	◗	◗	◗	◗	◗	◗	●
Build CRR spur from Salem to Danvers	Line Ext.	◗	❍	◗	◗	❍	◗	◗
CRR branch from existing Old Colony lines to Greenbush	New Line	●	●	●	◗	●	●	●
CRR to Millis	Line Ext.	◗	◗	◗	◗	◗	◗	●
CRR to New Bedford/ Fall River	Line Ext.	●	●	●	◗	●	●	●
Extend CRR from Providence to T.F. Green (RI)	Line Ext.	◗	❍	❍	❍	◗	◗	◗
Extend CRR from Fitchburg to Gardner	Line Ext.	❍	❍	❍	❍	❍	❍	❍
Extend CRR from Forge Park to Milford	Line Ext.	◗	❍	◗	❍	◗	◗	◗
Extend CRR from Haverhill to Plaistow	Line Ext.	◗	◗	◗	◗	◗	◗	●
Extend CRR from Lowell to Nashua	Line Ext.	◗	◗	◗	◗	●	◗	●
Extend CRR from Middleborough to Wareham	Line Ext.	◗	❍	❍	❍	◗	◗	◗
Extend passenger rail service from Wareham to Hyannis	Line Ext.	❍	❍	◗	❍	◗	◗	◗
North-South Rail Link	Line Ext.	●	●	●	●	●	●	●
Operate full-time service to Foxboro Sta.	Line Ext.	❍	❍	❍	◗	❍	❍	❍
Operate high-frequency Riverside – South Station CRR	Line Ext.	❍	❍	❍	❍	❍	❍	❍
Operate high-frequency Riverside – JFK/Umass CRR	Line Ext.	◗	❍	❍	◗	❍	❍	◗
Operate high-frequency CRR Readville – Allston Landing	Line Ext.	❍	❍	❍	❍	❍	❍	❍
Add station at Millbury on the Framingham/Worcester line	New Station	❍	❍	❍	❍	❍	❍	❍
Add a station at So. Salem on Rockport/Newburyport CRR line	New Station	◗	❍	❍	❍	❍	❍	❍
Build a new Allston/ Brighton CRR station	New Station	❍	❍	❍	❍	❍	❍	❍
Build a new CRR station on the Fitchburg Line at Union Sq, Somerville	New Station	❍	❍	❍	❍	❍	❍	❍
Build a regional CRR station along Rt 2 west of I-495	New Station	❍	❍	❍	❍	❍	❍	❍
Build regional CRR station on I-495 in Metrowest	New Station	◗	❍	◗	❍	◗	◗	◗
Connect Fitchburg CRR w/ Red Line at Alewife	New Station	❍	❍	❍	❍	❍	❍	❍
Fairmount Line Imps.	New Station	●	❍	❍	◗	❍	◗	◗
New CRR station at Riverside	New Station	❍	❍	❍	❍	❍	❍	❍

TABLE B-45 CRR PROJECT EVALUATION – MOBILITY

Project Description	Type	Service to Areas With Unmet Demand	Service During Time Periods With Unmet Demand	Service to Underserved Employment Centers	Total
Build CRR spur from Framingham to Leominster	Line Ext.	●	❍	◗	●
Build CRR spur from Salem to Danvers	Line Ext.	◗	❍	◗	●
CRR branch from existing Old Colony lines to Greenbush	New Line	●	◗	❍	●
CRR to Millis	Line Ext.	●	◗	❍	●
CRR to New Bedford/Fall River	Line Ext.	●	❍	◗	●
Extend CRR from Providence to T.F. Green (RI)	Line Ext.	◗	❍	◗	●
Extend CRR from Fitchburg to Gardner	Line Ext.	●	❍	◗	●
Extend CRR from Forge Park to Milford	Line Ext.	◗	❍	◗	●
Extend CRR from Haverhill to Plaistow, NH	Line Ext.	❍	❍	❍	❍
Extend CRR from Lowell to Nashua, NH	Line Ext.	●	❍	●	●
Extend CRR from Middleborough to Wareham	Line Ext.	◗	◗	❍	●
Extend passenger rail service from Wareham to Hyannis	Line Ext.	❍	❍	❍	❍
North-South Rail Link	Line Ext.	◗	❍	❍	◗
Operate full-time service to Foxboro Sta.	Line Ext.	◗	❍	❍	◗
Operate high-frequency Riverside – South Station CRR	Line Ext.	❍	❍	❍	❍
Operate high-frequency Riverside – JFK/Umass CRR	Line Ext.	❍	❍	❍	❍
Operate high-frequency Readville – Allston Landing CRR	Line Ext.	◗	❍	❍	◗
Add station at Millbury on the Framingham/Worcester line	New Station	◗	❍	❍	◗
Add a station at So. Salem on Rockport/Newburyport line	New Station	❍	❍	◗	◗
Build a new Allston/ Brighton CRR station	New Station	◗	❍	❍	◗
Build a new CRR station on the Fitchburg Line at Union Sq, Somerville	New Station	◗	❍	❍	◗
Build a regional CRR station along Rt 2 west of I-495	New Station	❍	❍	❍	❍
Build regional CRR station on I-495 in Metrowest	New Station	❍	❍	❍	❍
Connect Fitchburg CRR w/ Red Line at Alewife	New Station	❍	❍	❍	❍
Fairmount Line Imps.	New Station	●	❍	❍	●
New CRR station at Riverside	New Station	❍	❍	❍	❍

TABLE B-46	CRR PROJECT EVALUATION – COST EFFECTIVENESS					
Project Description	Type	Capital Cost Per New Transit Rider	Operating Cost Per New Transit Rider	Capital Cost Per Unit Travel Time Savings	Operating Per Unit Travel Time Savings	Total
Build CRR spur from Framingham to Leominster	Line Ext.	❍	❍	❍	❍	❍
Build CRR spur from Salem to Danvers	Line Ext.	◗	◗	◗	◗	◗
CRR branch from existing Old Colony lines to Greenbush	New Line	◗	◗			◗
CRR to Millis	Line Ext.	●	◗	❍	◗	◗
CRR to New Bedford/Fall River	Line Ext.	●	◗	❍	◗	◗
Extend CRR from Providence to T.F. Green (RI)	Line Ext.	◗	◗	◗	◗	◗
Extend CRR from Fitchburg to Gardner	Line Ext.	❍	❍	❍	❍	❍
Extend CRR from Forge Park to Milford	Line Ext.	◗	●	◗	◗	◗
Extend CRR from Haverhill to Plaistow, NH	Line Ext.	◗	●	◗	◗	◗
Extend CRR from Lowell to Nashua, NH	Line Ext.	●	◗	●	◗	◗
Extend CRR from Middleborough to Wareham	Line Ext.	◗	❍	◗	◗	❍
Extend passenger rail service from Wareham to Hyannis	Line Ext.	◗	❍	◗	❍	❍
North-South Rail Link	Line Ext.	❍	●	❍	●	◗
Operate full-time service to Foxboro Sta.	Line Ext.	◗	❍	❍	❍	❍
Operate high-frequency Riverside – South Station CRR	Line Ext.	❍	❍	❍	❍	❍
Operate high-frequency Riverside – JFK/Umass CRR	Line Ext.	❍	❍	❍	❍	❍
Operate high-frequency Readville – Allston Landing CRR	Line Ext.	❍	❍	❍	❍	❍
Add station at Millbury on the Framingham/Worcester line	New Station	●	N/A	●	N/A	●
Add a station at So. Salem on Rockport/Newburyport line	New Station	●	N/A	●	N/A	●
Build a new Allston/ Brighton CRR station	New Station	◗	N/A	◗	N/A	◗
Build a new CRR station on the Fitchburg Line at Union Sq, Somerville	New Station	●	N/A	●	N/A	●
Build a regional CRR station along Rt 2 west of I-495	New Station	❍	N/A	❍	N/A	❍
Build regional CRR station on I-495 in Metrowest	New Station	◗	N/A	❍	N/A	◗
Connect Fitchburg CRR w/ Red Line at Alewife	New Station	◗	N/A	❍	N/A	◗
Fairmount Line Imps.	New Station	❍	◗	◗	●	◗
New CRR station at Riverside	New Station	●	N/A	◗	N/A	●

TABLE B-47 CRR PROJECT EVALUATION – AIR QUALITY

Project Description	Type	Reduct. in VOC	Reduct. in NOx	Reduct. in CO	Reduct. in CO_2	Capital Cost Per Reduct. in VOC	Capital Cost Per Reduct. in NOx	Capital Cost Per Reduct. in CO	Capital Cost Per Reduct. in CO_2	Total
Build CRR spur from Framingham to Leominster	Line Ext.	❍	❍	◗	◗	❍	❍	❍	◗	❍
Build CRR spur from Salem to Danvers	Line Ext.	◗	❍	◗	◗	●	❍	◗	●	◗
CRR branch from existing Old Colony lines to Greenbush	New Line	●	❍	●	●	●	❍	◗	◗	◗
CRR to Millis	Line Ext.	◗	❍	●	◗	●	❍	◗	●	◗
CRR to New Bedford/Fall River	Line Ext.	●	❍	●	●	●	❍	◗	●	◗
Extend CRR from Providence to T.F. Green (RI)	Line Ext.	◗	❍	◗	◗	●	❍	◗	●	◗
Extend CRR from Fitchburg to Gardner	Line Ext.	❍	❍	❍	❍	❍	❍	❍	❍	❍
Extend CRR from Forge Park to Milford	Line Ext.	◗	❍	◗	◗	●	❍	◗	●	◗
Extend CRR from Haverhill to Plaistow	Line Ext.	◗	●	●	◗	●	●	●	●	●
Extend CRR from Lowell to Nashua	Line Ext.	●	❍	●	●	●	❍	●	●	●
Extend CRR from Middleborough to Wareham	Line Ext.	◗	❍	◗	◗	●	❍	◗	●	◗
Extend passenger rail service from Wareham to Hyannis	Line Ext.	●	❍	●	●	●	❍	●	●	●
North-South Rail Link	Line Ext.	●	❍	●	●	◗	❍	❍	◗	◗
Operate full-time service to Foxboro Sta.	Line Ext.	◗	●	◗	◗	●	●	◗	◗	◗
Operate high-frequency Riverside – South Station CRR	Line Ext.	❍	❍	❍	❍	❍	❍	❍	❍	❍
Operate high-frequency Riverside – JFK/Umass CRR	Line Ext.	❍	❍	❍	❍	❍	❍	❍	❍	❍
Operate high-frequency Readville-Allston Landing CRR	Line Ext.	❍	❍	❍	❍	❍	❍	❍	❍	❍
Add station at Millbury on the Framingham/ Worcester CRR line	New Station	◗	◗	❍	❍	●	●	◗	●	◗
Add a station at So. Salem on Rockport/Newburyport line	New Station	◗	●	◗	◗	●	●	●	●	●
Build a new Allston/ Brighton CRR station	New Station	◗	◗	❍	❍	◗	◗	❍	❍	◗
Build a new CRR station on the Fitchburg Line at Union Sq, Somerville	New Station	◗	◗	❍	❍	●	●	◗	◗	◗
Build a regional CRR station along Rt 2 west of I-495	New Station	◗	◗	❍	◗	◗	❍	◗	◗	◗
Build regional CRR station on I-495 in Metrowest	New Station	◗	●	◗	◗	●	●	◗	●	●
Connect Fitchburg CRR w/ Red Line at Alewife	New Station	◗	❍	◗	❍	◗	◗	❍	❍	◗
Fairmount Line Imps.	New Sta.	❍	❍	❍	❍	❍	❍	❍	❍	❍
New CRR station at Riverside	New Station	◗	◗	❍	❍	●	●	◗	●	◗

TABLE B-48 CRR PROJECT EVALUATION – SERVICE QUALITY

Project Description	Type	Safety/ Security	Comfort/ Convenience	Reliability	Inter-. connectivity	Customer Info.	Minimize Transfers	Total
Build CRR spur from Framinghamto Leominster	Line Ext.	❍	❍	❍	◗	❍	❍	❍
Build CRR spur from Salem to Danvers	Line Ext.	❍	❍	❍	❍	❍	❍	❍
CRR branch from existing Old Colony lines to Greenbush	New Line	❍	❍	❍	❍	❍	❍	❍
CRR to Millis	Line Ext.	❍	❍	❍	❍	❍	❍	❍
CRR to New Bedford/ Fall River	Line Ext.	❍	❍	❍	❍	❍	❍	❍
Extend CRR from Providence to T.F. Green (RI)	Line Ext.	❍	❍	❍	●	❍	◗	◗
Extend CRR from Fitchburg to Gardner	Line Ext.	❍	❍	❍	❍	❍	◗	❍
Extend CRR from Forge Park to Milford	Line Ext.	❍	❍	❍	❍	❍	❍	❍
Extend CRR from Haverhill to Plaistow	Line Ext.	❍	❍	❍	❍	❍	❍	❍
Extend CRR from Lowell to Nashua	Line Ext.	❍	❍	❍	◗	❍	❍	❍
Extend CRR from Middleborough to Wareham	Line Ext.	❍	❍	❍	❍	❍	❍	❍
Extend passenger rail service from Wareham to Hyannis	Line Ext.	❍	❍	❍	◗	❍	◗	❍
North-South Rail Link	Line Ext.	❍	❍	❍	●	❍	●	◗
Operate full-time service to Foxboro Sta.	Line Ext.	❍	❍	❍	❍	❍	❍	❍
Operate high-frequency Riverside – South Station CRR	Line Ext.	❍	❍	❍	◗	❍	❍	❍
Operate high-frequency Riverside – JFK/Umass CRR	Line Ext.	❍	❍	❍	◗	❍	❍	❍
Operate high-frequency Readville – Allston Landing CRR	Line Ext.	❍	❍	❍	◗	❍	❍	❍
Add station at Millbury on the Framingham/ Worcester CRR line	New Station	❍	❍	❍	❍	❍	❍	❍
Add a station at So. Salem on Rockport/Newburyport line	New Station	❍	❍	❍	❍	❍	◗	❍
Build a new Allston/ Brighton CRR station	New Station	❍	❍	❍	◗	❍	◗	❍
Build a new CRR station on the Fitchburg Line at Union Sq, Somerville	New Station	❍	❍	❍	◗	❍	◗	❍
Build a regional CRR station along Rt 2 west of I-495	New Station	❍	❍	❍	❍	❍	❍	❍
Build regional CRR station on I-495 in Metrowest	New Station	❍	❍	❍	◗	❍	❍	❍
Connect Fitchburg CRR w/ Red Line at Alewife	New Station	❍	❍	❍	◗	❍	●	◗
Fairmount Line Imps.	New Sta.	◗	●	❍	❍	◗	●	●
New CRR station at Riverside	New Station	❍	❍	❍	◗	❍	●	◗

TABLE B-49 CRR PROJECT EVALUATION – ECONOMIC & LAND USE IMPACTS

Project Description	Type	State Revitalization Area	Local Plans	Regional Plans	Brownfield/ Infill Development	Total
Build CRR spur from Framingham to Leominster	Line Ext.	●		N/A	◗	●
Build CRR spur from Salem to Danvers	Line Ext.	◗	❍	◗	◗	❍
CRR branch from existing Old Colony lines to Greenbush	New Line	◗	❍	❍	❍	❍
CRR to Millis	Line Ext.	❍	❍	❍	◗	❍
CRR to New Bedford/Fall River	Line Ext.	●	❍	N/A	◗	◗
Extend CRR from Providence to T.F. Green (RI)	Line Ext.	❍		N/A	❍	❍
Extend CRR from Fitchburg to Gardner	Line Ext.	●		N/A	◗	●
Extend CRR from Forge Park to Milford	Line Ext.	◗	❍	❍	◗	❍
Extend CRR from Haverhill to Plaistow, NH	Line Ext.	❍		N/A	❍	❍
Extend CRR from Lowell to Nashua, NH	Line Ext.	❍		N/A	N/A	❍
Extend CRR from Middleborough to Wareham	Line Ext.	◗		N/A	◗	◗
Extend passenger rail service from Wareham to Hyannis	Line Ext.	◗	❍	N/A	◗	❍
North-South Rail Link	Line Ext.	●	●	●	◗	●
Operate full-time service to Foxboro Sta.	Line Ext.	❍	❍	❍	◗	❍
Operate high-frequency Riverside – South Station CRR	Line Ext.	◗	◗	●	◗	◗
Operate high-frequency Riverside – JFK/Umass CRR	Line Ext.	◗	◗	●	◗	◗
Operate high-frequency Readville – Allston Landing CRR	Line Ext.	●	◗	●	◗	●
Add station at Millbury on the Framingham/Worcester line	New Sta.	●		N/A	◗	●
Add a station at So. Salem on Rockport/Newburyport line	New Sta.	●	❍	●	◗	◗
Build a new Allston/ Brighton CRR station	New Sta.	●	◗	●	◗	●
Build a new CRR station on the Fitchburg Line at Union Sq, Somerville	New Sta.	●	●	●	◗	●
Build a regional CRR station along Rt 2 west of I-495	New Sta.	❍	❍	❍	❍	❍
Build regional CRR station on I-495 in Metrowest	New Sta.	❍	❍	❍	❍	❍
Connect Fitchburg CRR w/ Red Line at Alewife	New Sta.	●	●	●	◗	●
Fairmount Line Imps.	New Sta.	●	◗	●	◗	●
New CRR station at Riverside	New Sta.	❍	❍	●	❍	❍

TABLE B-50 CRR PROJECT EVALUATION – ENVIRONMENTAL JUSTICE

Project Description	Type	Serves Target Neighbrhds	Rectify Barriers	Responds to EJ Issues in RTP	Avoids Burdens Without Benefits	Total
Build CRR spur from Framingham to Leominster	Line Ext.	◗	❍	❍	●	◗
Build CRR spur from Salem to Danvers	Line Ext.	◗	❍	❍	●	◗
CRR branch from existing Old Colony lines to Greenbush	New Line	❍	❍	❍	●	❍
CRR to Millis	Line Ext.	❍	❍	❍	●	❍
CRR to New Bedford/Fall River	Line Ext.	◗	❍	❍	●	◗
Extend CRR from Providence to T.F. Green (RI)	Line Ext.	❍	❍	❍	●	❍
Extend CRR from Fitchburg to Gardner	Line Ext.	◗	❍	❍	●	◗
Extend CRR from Forge Park to Milford	Line Ext.	◗	❍	❍	●	◗
Extend CRR from Haverhill to Plaistow, NH	Line Ext.	❍	❍	❍	●	❍
Extend CRR from Lowell to Nashua, NH	Line Ext.	❍	❍	❍	●	❍
Extend CRR from Middleborough to Wareham	Line Ext.	❍	❍	❍	●	❍
Extend passenger rail service from Wareham to Hyannis	Line Ext.	❍	❍	❍	●	❍
North-South Rail Link	Line Ext.	◗	◗	❍	●	◗
Operate full-time service to Foxboro Sta.	Line Ext.	❍	❍	❍	●	❍
Operate high-frequency Riverside – South Station CRR	Line Ext.	❍	❍	❍	●	❍
Operate high-frequency Riverside – JFK/Umass CRR	Line Ext.	◗	❍	❍	●	◗
Operate high-frequency Readville – Allston Landing CRR	Line Ext.	●	●	●	●	●
Add station at Millbury on the Framingham/Worcester line	New Station	❍	❍	❍	●	❍
Add a station at So. Salem on Rockport/Newburyport line	New Station	◗	◗	❍	●	◗
Build a new Allston/ Brighton CRR station	New Station	●	◗	❍	●	●
Build a new CRR station on the Fitchburg Line at Union Sq, Somerville	New Station	◗	●	❍	●	●
Build a regional CRRstation along Rt 2 west of I-495	New Station	❍	❍	❍	●	❍
Build regional CRR station on I-495 in Metrowest	New Station	❍	❍	❍	●	❍
Connect Fitchburg CRR w/ Red Line at Alewife	New Station	❍	❍	❍	◗	❍
Fairmount Line Imps.	New Station	●	●	●	●	●
New CRR station at Riverside	New Station	❍	❍	❍	●	❍

TABLE B-51 CRR PROJECT EVALUATION – OVERALL

Project Description	Type	Utilization	Mobility	Cost Effective	Air Quality	Service Quality	Econ/Land Use Impacts	Environ. Justice	Total
Build CRR spur from Framingham to Leominster	Line Ext.	●	●	❍	❍	❍	●	◗	◗
Build CRR spur from Salem to Danvers	Line Ext.	◗	●	◗	◗	❍	❍	◗	●
CRR branch from existing Old Colony lines to Greenbush	New Line	●	●	◗	◗	❍	❍	❍	●
CRR to Millis	Line Ext.	●	●	◗	◗	❍	❍	❍	◗
CRR to New Bedford/Fall River	Line Ext.	●	●	◗	◗	❍	◗	◗	●
Extend CRR from Providence to T.F. Green (RI)	Line Ext.	◗	●	◗	◗	◗	❍	❍	◗
Extend CRR from Fitchburg to Gardner	Line Ext.	❍	●	❍	❍	❍	●	◗	◗
Extend CRR from Forge Park to Milford	Line Ext.	◗	●	◗	◗	❍	❍	◗	◗
Extend CRR from Haverhill to Plaistow	Line Ext.	●	❍	●	●	❍	❍	❍	◗
Extend CRR from Lowell to Nashua	Line Ext.	●	●	◗	●	❍	❍	❍	◗
Extend CRR from Middleborough to Wareham	Line Ext.	◗	●	❍	◗	❍	◗	❍	◗
Extend passenger rail service from Wareham to Hyannis	Line Ext.	◗	❍	❍	●	❍	❍	❍	❍
North-South Rail Link	Line Ext.	●	◗	◗	◗	◗	●	◗	●
Operate full time service to Foxboro Sta.	Line Ext.	❍	◗	❍	◗	❍	❍	❍	❍
Operate high-frequency Riverside – South Station CRR	Line Ext.	❍	❍	❍	❍	❍	◗	❍	❍
Operate high-frequency Riverside – JFK/Umass CRR	Line Ext.	◗	❍	❍	❍	❍	◗	◗	❍
Operate high-frequency Readville – Allston Landing CRR	Line Ext.	❍	◗	❍	❍	❍	●	●	◗
Add station at Millbury on the Framingham/Worcester line	New Station	❍	◗	●	◗	❍	●	❍	◗
Add a station at So. Salem on Rockport/Newburyport line	New Station	❍	◗	●	●	❍	◗	◗	◗
Build a new Allston/ Brighton CRR station	New Station	❍	◗	◗	◗	❍	●	●	◗
Build a new CRR station on the Fitchburg Line at Union Sq, Somerville	New Station	❍	◗	●	◗	❍	●	●	●
Build a regional CRR station along Rt 2 west of I-495	New Station	❍	❍	❍	◗	❍	❍	❍	❍
Build regional CRR station on I-495 in Metrowest	New Station	◗	❍	◗	●	❍	❍	❍	◗
Connect Fitchburg CRR w/ Red Line at Alewife	New Station	❍	❍	◗	◗	◗	●	❍	◗
Fairmount Line Imps.	New Station	◗	●	◗	❍	●	●	●	●
New CRR station at Riverside	New Station	❍	❍	●	◗	◗	❍	❍	◗

TABLE B-52 BOAT PROJECT EVALUATION – UTILIZATION

Project Description	Type	Ridership	New Riders	Impact on Mode Share	Reduct. in Crowd-ing	Reduct. in VMT	Travel Time Savings	Total
Ferry Expansion-Russia Wharf/ South Station	Line Extension/ New Line	●	●	❍	❍	❍	❍	◗
High-Speed Ferry Service From the North Shore to Boston & the Airport	Line Extension/ New Line	❍	❍	◗	◗	◗	◗	◗
Restore East Boston ferry	Line Extension/ New Line	❍	❍	❍	❍	❍	❍	❍
Improved Ferry Service From South Shore Communities (Quincy, Hingham and Hull) to Boston.	Frequency Improvement	◗	◗	●	●	●	●	●

TABLE B-53 BOAT PROJECT EVALUATION – MOBILITY					
Project Description	Type	Service to Areas with Unmet Demand	Service During Time with Unmet Demand	Service to Underserved Employment Centers	Total
Ferry Expansion-Russia Wharf/ South Station	Line Extension/ New Line	◗	❍	❍	◗
High-Speed Ferry Service From the North Shore to Boston & the Airport	Line Extension/ New Line	❍	❍	❍	❍
Restore East Boston ferry	Line Extension/ New Line	❍	❍	❍	❍
Improved Ferry Service From South Shore Communities (Quincy, Hingham and Hull) to Boston.	Frequency Improvement	❍	◗	❍	◗

TABLE B-54 BOAT PROJECT EVALUATION – COST EFFECTIVENESS

Project Description	Type	Capital Cost Per New Transit Rider	Net Operating Costs Per New Transit Rider	Capital Cost Per Unit Travel Time Savings	Net Operating Costs Per Unit Travel Time Savings	Total
Ferry Expansion- Russia Wharf/ South Station	Line Extension/ New Line	●	◗	◗	●	●
High-Speed Ferry Service From the North Shore to Boston & the Airport	Line Extension/ New Line	◗	❍	◗	◗	❍
Restore East Boston ferry	Line Extension/ New Line	●	●	❍	❍	◗
Improved Ferry Service From South Shore Communities (Quincy, Hingham and Hull) to Boston.	Frequency Improvement	❍	❍	●	●	◗

TABLE B-55 BOAT PROJECT EVALUATION – AIR QUALITY

Project Description	Type	Reduction in VOC	Reduction in NOx	Reduction in CO	Reduction in CO_2	Total
Ferry Expansion-Russia Wharf/ South Station	Line Extension/ New Line	❍	❍	❍	❍	❍
High-Speed Ferry Service From the North Shore to Boston & the Airport	Line Extension/ New Line	❍	❍	❍	❍	❍
Restore East Boston ferry	Line Extension/ New Line	❍	❍	❍	❍	❍
Improved Ferry Service From South Shore Communities (Quincy, Hingham and Hull) to Boston.	Frequency Improvement	❍	❍	❍	❍	❍

TABLE B-56 BOAT PROJECT EVALUATION – SERVICE QUALITY

Project Description	Type	Safety/ Security	Comfort/ Convenience	Reliability	Inter connectivity	Customer Informa-tion	Minimize Transfers	Total
Ferry Expansion-Russia Wharf/ South Station	Line Extension/ New Line	❍	❍	❍	●	❍	◗	◗
High-Speed Ferry Service From the North Shore to Boston & the Airport	Line Extension/ New Line	❍	❍	❍	❍	❍	❍	❍
Restore East Boston ferry	Line Extension/ New Line	❍	❍	❍	❍	❍	◗	❍
Improved Ferry Service From South Shore Communities (Quincy, Hingham and Hull) to Boston.	Frequency Improvement	❍	❍	❍	❍	❍	❍	❍

TABLE B-57 BOAT PROJECT EVALUATION – ECONOMIC AND LAND USE IMPACTS

Project Description	Type	State Revitaliza-tion Area	Local Plans	Regional Plans	Brownfield/ Infill Development	Total
Ferry Expansion-Russia Wharf/ South Station	Line Extension/ New Line	●	◗	●	◗	●
High-Speed Ferry Service From the North Shore to Boston and the Airport	Line Extension/ New Line	●	❍	●	◗	◗
Restore East Boston ferry	Line Extension/ New Line	●	◗	●	◗	●
Improved Ferry Service From South Shore Communities (Quincy, Hingham and Hull) to Boston.	Frequency Improvement	◗	❍	◗	❍	❍

TABLE B-58 BOAT PROJECT EVALUATION – ENVIRONMENTAL JUSTICE

Project Description	Type	Serves Target Neighbor-hoods	Rectify Barriers	Responds to EJ Issues in RTP	Avoids Burdens Without Benefits	Total
Ferry Expansion-Russia Wharf/ South Station	Line Extension/ New Line	❍	❍	❍	N/A	❍
High-Speed Ferry Service From the North Shore to Boston and the Airport	Line Extension/ New Line	◗	❍	❍	●	◗
Restore East Boston ferry	Line Extension/ New Line	●	❍	❍	●	●
Improved Ferry Service From South Shore Communities (Quincy, Hingham and Hull) to Boston.	Frequency Improvement	◗	❍	❍	●	◗

TABLE B-59 BOAT PROJECT EVALUATION – OVERALL

Project Description	Type	Utilization	Mobility	Cost Effective	Air Quality	Service Quality	Economic/ Land Use Impacts	Environ. Justice	Total
Russia Wharf/ South Station	Line Extension/ New Line	◗	◗	●	❍	◗	●	❍	●
High-Speed Ferry Service From the North Shore to Boston and the Airport	Line Extension/ New Line	◗	❍	❍	❍	❍	◗	◗	❍
Restore East Boston ferry	Line Extension/ New Line	❍	❍	◗	❍	❍	●	●	◗
Improved Ferry Service From South Shore Communities (Quincy, Hingham and Hull) to Boston.	Frequency Improvement	●	◗	◗	❍	❍	❍	◗	◗

APPENDIX C

Projected Impacts of System Expansion and Service Enhancement Projects

The following tables provide detailed information on the projected costs of system expansion and service enhancement projects, as well as projected impacts on travel volumes. More specifically, projections of increased ridership resulting from each capital improvement are included, along with anticipated new riders to the transit system, travel time savings, air quality impacts, and other related figures. Both operating and capital costs are also summarized, along with ratios of cost to projected new transit ridership, regional travel time savings, and unit air quality improvements.

TABLE C-1 RAPID TRANSIT ENHANCEMENT CAPITAL COSTS AND TRAVEL TIME SAVINGS

Projects	Total	New Riders	Cost Per New Rider	Time Savings (hrs)	Cost per Hour Saved	Cost per Reduc. CO2	Cost per Reduc. VOC	Cost per Reduc. NOx	Cost per Reduc. CO
Commonwealth Flats Silver Line Grade Separation	$70,000,000	100	$700,000	-3	-$26,250,000	-$215,750	-$218,280,002	-$108,151,276	-$19,353,670
Operate 4-Car Trains on Green Line	$339,363,769	410	$827,717	-116	-$2,921,352	-$89,860	-$91,123,497	-$44,992,227	-$8,079,412
Operate 8-Car Trains on Orange Line	$177,663,692	660	$269,187	-149	-$1,196,389	-$25,668	-$26,029,022	-$12,851,830	-$2,307,848
Operate 8-Car Trains on Red Line	$261,312,923	950	$275,066	-162	-$1,610,061	-$25,588	-$25,948,088	-$12,811,869	-$2,300,672
Preemptive Signals on Beacon/Comm/Huntington	$492,480	60	$8,208	-17	-$29,847	-$764	-$774,313	-$382,317	-$68,654
Signal improvements on Blue Line	$228,084,524	2700	$84,476	-490	-$465,875	-$7,004	-$7,102,926	-$3,507,070	-$629,777
Signal improvements on Green Line	$327,040,407	None	N/A	None	N/A	N/A	N/A	N/A	N/A
Signal improvements on Orange Line	$366,970,933	4470	$82,096	-815	-$450,317	-$7,639	-$7,746,380	-$3,824,775	-$686,828
Signal improvements on Red Line	$789,409,153	3380	$233,553	-545	-$1,448,014	-$21,743	-$22,049,054	-$10,886,720	-$1,954,967

TABLE C-2 RAPID TRANSIT ENHANCEMENT OPERATING COSTS

Project	New Riders	Operating Cost	Operating Costs per New Rider	Travel Time Savings (hrs)	Operating Cost Per Hour Saved
Commonwealth Flats Silver Line Grade Separation	100	None	N/A	-3	N/A
Operate 4-Car Trains on Green Line	410	$267,731	$653.00	-116	-$2,305
Operate 8-Car Trains on Orange Line	660	$26,047	$39.47	-149	-$175
Operate 8-Car Trains on Red Line	950	$42,945	$45.21	-162	-$265
Preemptive Signals on Beacon/Comm/Huntington	60	None	N/A	-17	$0
Signal improvements on Blue Line	2700	$41,522	$15.38	-490	-$85
Signal improvements on Green Line	None	None	N/A	None	N/A
Signal improvements on Orange Line	4470	$78,143	$17.48	-815	-$96
Signal improvements on Red Line	3380	$128,836	$38.12	-545	-$236

TABLE C-3 RAPID TRANSIT ENHANCEMENT RIDERSHIP AND AIR QUALITY

Project	Changes in System Ridership	New Transit Trips in the System	VMT	CO2 kg	VOC kg	NOx kg	CO kg	Mode Share Rating	Crowding Relief Rating
Commonwealth Flats Silver Line Grade Separation	180	100	-450	-324	0	-1	-4	Low	Low
Operate 4-car trains on Green Line	4100	410	-5238	-3776.6	-3.7242	-7.5427	-42.004	Medium	High
Operate 8-car trains on Orange Line	3300	660	-9600	-6921.6	-6.8256	-13.824	-76.982	Medium	High
Operate 8-car trains on Red Line	3800	950	-14164	-10212	-10.071	-20.396	-113.58	Medium	High
Preemptive Signals on Beacon/Comm/Huntington	270	60	-894.55	-644.97	-0.636	-1.2881	-7.1734	Low	Low
Signal improvements on Blue Line	8800	2700	-45164	-32563	-32.111	-65.036	-362.17	High	High
Signal improvements on Green Line	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Signal improvements on Orange Line	10900	4470	-66629	-48040	-47.373	-95.946	-534.3	High	High
Signal improvements on Red Line	9650	3380	-50355	-36306	-35.802	-72.511	-403.8	High	High

TABLE C-4 BUS ENHANCEMENT CAPITAL COSTS AND TRAVEL TIME SAVINGS

Project	Capital Costs	New Riders	Cap per New Rider	Travel Time Savings (hrs)	Cost per Hour Saved	Cap/CO2	Cap/VOC	Cap/NOx	Cap/CO
Add bus lanes & priority signals on top 10 busiest bus routes	$53,118,200	780	$68,100	-251	-$211,908	-$6,927	-$7,023,936	-$3,468,069	-$622,773
Aquire 100 New Buses	$33,800,000	1430	$23,636	-918	-$36,836	$3,582	-$7,409,681	$403,053	-$639,764
Install 300 Shelters	$1,000,000	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Install ITS System	TBD	None	N/A	N/A	N/A	N/A	N/A	N/A	N/A

TABLE C-5 BUS ENHANCEMENT RIDERSHIP AND AIR QUALITY

Project	Additional Ridership by Mode	New Transit Trips in the System	VMT	CO2 kg	VOC kg	NOx kg	CO kg	Mode Share Rating	Crowding Relief Rating
Add bus lanes & priority signals on top 10 busiest bus routes	2980	780	-10636.4	-7668.82	-7.56245	-15.3164	-85.293	Medium	Low
Aquire 100 New Buses	5720	1430	-10400	9436	-4.5616	83.86	-52.832	Medium	Medium

TABLE C-6 COMMUTER RAIL ENHANCEMENT CAPITAL COSTS AND TRAVEL TIME SAVINGS

Project	Total Capital Cost	New Transit Ridership	Cost per New Rider	Travel Time Savings (hrs)	Cost per Hour Saved	Cost per Reduc. CO2	Cost per Reduc. VOC	Cost per Reduc. NOx	Cost per Reduc. CO
Install platforms on both sides of stations in Newton for reverse commuting	$5,220,600	10	$522,060	-1	-$5,220,600	-$44,242	N/A	N/A	-$5,220,600
Improve pedestrian access to Anderson RTC from western side of tracks	$1,553,750	20	$77,688	-2	-$776,875	-$6,967	N/A	N/A	-$776,875
Increase speed and frequency of Needham service	$52,321,600	230	$227,485	-78	-$670,790	-$21,164	$88,571,499	$910,223	-$2,583,783
Purchase DMU trains to allow for increased frequency on commuter rail lines	$264,448,800	310	$853,061	-79	-$3,347,453	$522,626	$13,918,358	$685,101	$5,288,976
Operate a Yawkey-Back Bay-South Station shuttle	$29,984,100	380	$78,906	-8	-$3,748,013	-$9,034	-$14,992,050	$2,306,469	-$856,689
Operate more frequent service between Framingham and Worcester	N/A	450	N/A	-220	N/A	N/A	N/A	N/A	N/A
Electrify all commuter rail lines (excluding yards)	$2,004,278,160	900	$2,226,976	-335	-$5,982,920	-$36,965	-$6,614,779	-$381,186	-$1,668,841
Operate Express Service from Outer Stations	$255,608,000	3040	$84,082	-1,491	-$171,491	-$7,032	-$15,975,500	$767,592	-$715,989
Expand Reverse Commuting Options	$82,727,700	3120	$26,515	-910	-$90,910	-$3,103	-$22,331,075	$203,383	-$340,519
Build new layover facility in Bellingham for the Franklin Line	$17,926,546	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Install a fourth track on the Fort Point Channel Bridge	$2,486,000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Install double-tracking on entire commuter rail system	$398,268,263	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

TABLE C-7 COMMUTER RAIL ENHANCEMENT OPERATING COSTS

Project	Added Daily Cost	New Transit Ridership	Op Cost per New Rider	Travel Time Savings (hrs)	Cost per Hour Saved
Install platforms on both sides of stations in Newton for reverse commuting	N/A	10	N/A	-1	N/A
Improve pedestrian access to Anderson RTC from western side of tracks	N/A	20	N/A	-2	N/A
Increase speed and frequency of Needham service	$13,925	230	$60.54	-78	-$178.53
Purchase DMU trains to allow for increased frequency on commuter rail lines	$7,500	310	$24.19	-79	-$94.94
Operate a Yawkey-Back Bay-South Station shuttle	$4,574	380	$12.04	-8	-$571.75
Operate more frequent service between Framingham and Worcester	$4,350	450	$9.67	-220	-$19.77
Electrify all commuter rail lines (excluding yards)	TBD	900	TBD	-335	TBD
Operate Express Service from Outer Stations	$53,397	3040	$17.56	-1491	-$35.82
Expand Reverse Commuting Options	$60,628	3120	$19.43	-910	-$66.62
Build new layover facility in Bellingham for the Franklin Line	N/A	N/A	N/A	N/A	N/A
Install a fourth track on the Fort Point Channel Bridge	N/A	N/A	N/A	N/A	N/A
Install double-tracking on entire commuter rail system	N/A	N/A	N/A	N/A	N/A

TABLE C-8 COMMUTER RAIL ENHANCEMENT RIDERSHIP AND AIR QUALITY

Project	System Ridership by Mode	New Transit Trips in the System	New Trips Causing Auto Diversions	VMT	CO2 kg	VOC kg	NOx kg	CO kg	Mode Share Rating	Crowding Rating
Install platforms on both sides of stations in Newton for reverse commuting	50	10	-9	-164	-118	0	0	-1	Low	Low
Improve pedestrian access to Anderson RTC from western side of tracks	40	20	-18	-309	-223	0	0	-2	Low	Low
Increase speed and frequency of Needham service	1,020	230	-209	-4,182	-2,472	1	57	-20	Medium	Low
Purchase DMU trains to allow for increased frequency on commuter rail lines	790	310	-282	-3,945	506	19	386	50	Medium	Low
Operate a Yawkey-Back Bay-South Station shuttle	1,400	380	-345	-4,836	-3,319	-2	13	-35	Low	Medium
Operate more frequent service between Framingham and Worcester	890	450	-410	-14,290	-10,015	-8	13	-108	Low	Low
Electrify all commuter rail lines (excluding yards)	1,650	900	-818	-13,091	-54,221	-303	-5,258	-1,201	Medium	Medium
Operate Express Service from Outer Stations	8,220	3,040	-2,760	-55,300	-36,349	-16	333	-357	Medium	Medium
Expand Reverse Commuting Options	7,800	3,120	-2,840	-42,520	-26,659	-4	407	-243	Low	Low
Build new layover facility in Bellingham for the Franklin Line	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Install a fourth track on the Fort Point Channel Bridge	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Install double-tracking on entire commuter rail system	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

TABLE C-9 RAPID TRANSIT EXPANSION CAPITAL COSTS AND TRAVEL TIME SAVINGS

Project	Capital Cost	New Riders	Cost per New Rider	Travel Time Savings (hrs)	Cost per Hour Saved	Cost per Reduc. CO2	Cost per Reduc. VOC	Cost per Reduc. NOx	Cost per Reduc. CO
Blue Line: Bowdoin to West Medford	$696,468,000	5830	$119,463	2,029	$343,299	-$18,569	-$18,829,955	-$9,329,685	-$1,669,547
Blue Line: Build Comm Rail connector at Wonderland	$70,035,000	500	$140,070	-116	-$604,619	-$13,624	-$14,007,000	-$6,366,818	-$1,187,034
Blue Line: Lynn to Salem	$363,800,000	8900	$40,876	-546	-$666,504	-$3,311	-$3,357,439	-$1,663,512	-$297,685
Blue Line: Wonderland to Lynn	$357,606,770	7900	$45,267	-1,005	-$355,828	-$4,409	-$4,470,783	-$2,215,141	-$396,399
Blue-Red Connector: Bowdoin to Charles/MGH	$174,625,000	2750	$63,500	-1,625	-$107,462	-$11,255	-$11,411,939	-$5,654,278	-$1,011,833
Green Line: Eliot to Needham Junction	$123,900,806	500	$247,802	-47	-$2,655,017	-$39,687	-$40,241,395	-$19,938,420	-$3,567,980
Green Line: Heath Street to Arborway	$71,882,000	200	$359,410	-6	-$11,115,773	-$70,210	-$71,240,710	-$35,297,662	-$6,316,516
Green Line: Lechmere to West Medford	$375,000,000	3540	$105,932	-1,647	-$227,641	-$18,756	-$19,021,547	-$9,424,613	-$1,686,535
Orange Line: Add a Station at Assembly Square	$29,282,400	1090	$26,865	-201	-$145,744	-$3,672	-$3,723,762	-$1,845,014	-$330,165
Orange Line: Forest Hills to Hyde Park/Rte 128	$342,803,479	1990	$172,263	-506	-$677,143	-$18,726	-$18,988,989	-$9,408,482	-$1,683,648
Orange Line: Forest Hills to West Rox/Needham	$316,230,000	615	$514,195	-113	-$2,804,701	-$78,508	$79,057,500	$39,528,750	$7,027,333
Orange Line: Oak Grove to Reading/Rte 128	$487,762,514	5390	$90,494	-1,179	-$413,779	-$10,615	-$10,765,155	-$5,333,815	-$954,486
Red Line: Alewife to Rte 128	$749,300,000	1700	$440,765	-1,777	-$421,745	-$44,795	-$45,504,919	-$22,546,340	-$4,034,667
Red Line: Braintree to Weymouth	$304,156,289	2900	$104,881	-304	-$999,966	-$10,666	-$10,817,593	-$5,359,797	-$959,136
Silver Line Phase III: South Station to Boylston via Chinatown	$951,900,000	4520	$210,597	-2,462	-$386,689	-$23,069	-$23,395,694	-$11,591,873	-$2,074,366
Silver Line: Convert to LRT - Dudley to Boylston	$373,556,971	130	$2,873,515	-581	-$642,826	-$539,822	-$373,556,971	-$373,556,971	-$46,694,621
Silver Line West Extension: Boylston to Allston & Longwood	$540,945,387	7840	$68,998	-873	-$619,640	-$13,153	-$13,339,438	-$6,609,296	-$1,182,734
Silver Line: Dudley Station to Ashmont and Mattapan	$43,701,138	1250	$34,961	-250	-$175,061	-$7,636	-$7,283,523	-$3,972,831	-$682,830
Silver Line East Extension: S. Station to City Point	$11,435,857	1360	$8,409	-159	-$71,924	-$1,279	-$1,039,623	-$879,681	-$83,473
Urban Ring Phase II	$500,000,000	15000	$33,333	-18,692	-$26,750	-$4,237	-$4,296,401	-$2,128,739	-$380,938
Urban Ring: Phase III - Sullivan to Dudley	$2,800,000,000	54600	$51,282	-49,695	-$56,344	-$6,259	-$6,346,681	-$3,144,592	-$562,725

TABLE C-10 RAPID TRANSIT EXPANSION OPERATING COSTS

Project	New Riders	Average Day Costs	Op Cost/New Rider	Travel Time Savings (hrs)	Cost per Hour Saved
Blue Line: Bowdoin to West Medford	5830	$76,801	$13.17	2,029	$37.86
Blue Line: Build Comm Rail connector at Wonderland	500	$0	None	-116	$0.00
Blue Line: Lynn to Salem	8900	$80,505	$9.05	-546	-$147.49
Blue Line: Wonderland to Lynn	7900	$72,454	$9.17	-1,005	-$72.09
Blue-Red Connector: Bowdoin to Charles/MGH	2750	$7,245	$2.63	-1,625	-$4.46
Green Line: Eliot to Needham Junction	500	$16,629	$33.26	-47	-$356.34
Green Line: Heath Street to Arborway	200	-$1,313	None	-6	$203.02
Green Line: Lechmere to West Medford	3540	$41,748	$11.79	-1,647	-$25.34
Orange Line: Add a Station at Assembly Square	1090	$0	None	-201	$0.00
Orange Line: Forest Hills to Hyde Park/Rte 128	1990	$94,885	$47.68	-506	-$187.43
Orange Line: Forest Hills to West Rox/Needham	615	$79,904	$129.93	-113	-$708.68
Orange Line: Oak Grove to Reading/Rte 128	5390	$109,482	$20.31	-1,179	-$92.88
Red Line: Alewife to Rte 128	1700	$121,837	$71.67	-1,777	-$68.58
Red Line: Braintree to Weymouth	2900	$52,021	$17.94	-304	-$171.03
Silver Line Phase III: South Station to Boylston via Chinatown	4520	$2,556	$0.57	-2,462	-$1.04
Silver Line: Convert to LRT - Dudley to Boylston	130	$6,064	$46.64	-581	-$10.43
Silver Line West Extension: Boylston to Allston & Longwood	7840	$25,621	$3.27	-873	-$29.35
Silver Line: Dudley Station to Ashmont and Mattapan	1250	-$6,790	None	-250	$27.20
Silver Line East Extension: S. Station to City Point	1360	$3,752	$2.76	-159	-$23.60
Urban Ring Phase II	15000	$70,736	$4.72	-18,692	-$3.78
Urban Ring: Phase III - Sullivan to Dudley	54600	$195,601	$3.58	-49,695	-$3.94

TABLE C-11 RAPID TRANSIT EXPANSION RIDERSHIP AND AIR QUALITY

Project	Changes in RTL System Ridership	New Transit Trips in the System	VMT	CO2 kg	VOC kg	NOx kg	CO kg	Mode Share Rating	Crowding Relief Rating
Blue Line: Bowdoin to West Medford	13525	5830	-52020	-37506	-37	-75	-417	Medium	Low
Blue Line: Build Comm Rail connector at Wonderland	850	500	-7130	-5141	-5	-11	-59	Medium	Low
Blue Line: Lynn to Salem	15850	9300	-152400	-109880	-108	-219	-1222	High	Low
Blue Line: Wonderland to Lynn	21000	7900	-112500	-81113	-80	-161	-902	Medium	Low
Blue-Red Connector: Bowdoin to Charles/MGH	6500	2750	-21520	-15516	-15	-31	-173	Medium	Medium
Green Line: Eliot to Needham Junction	3400	500	-4330	-3122	-3	-6	-35	Low	Low
Green Line: Heath Street to Arborway	14220	200	-1420	-1024	-1	-2	-11	Low	Low
Green Line: Lechmere to West Medford	8420	3540	-27730	-19993	-20	-40	-222	Medium	Low
Orange Line: Add a Station at Assembly Square	1740	1090	-11060	-7974	-8	-16	-89	Medium	Low
Orange Line: Forest Hills to Hyde Park/Rte 128	4740	1990	-25390	-18306	-18	-36	-204	Low	Low
Orange Line: Forest Hills to West Rox/Needham	11278	615	-5587	-4028	4	8	45	Low	Low
Orange Line: Oak Grove to Reading/Rte 128	9430	5390	-63730	-45949	-45	-91	-511	Medium	Low
Red Line: Alewife to Rte 128	6710	1700	-23200	-16727	-16	-33	-186	Low	Low
Red Line: Braintree to Weymouth	6650	2900	-39550	-28516	-28	-57	-317	Medium	Medium
Silver Line Phase III: South Station to Boylston via Chinatown	20500	4520	-57230	-41263	-41	-82	-459	High	Medium
Silver Line: Convert to LRT - Dudley to Boylston	34282	130	-960	-692	-1	-1	-8	Low	Low
Silver Line West Extension: Boylston to Allston & Longwood	27940	7840	-57040	-41126	-41	-82	-457	High	Medium
Silver Line: Dudley Station to Ashmont and Mattapan	29330	1250	-7950	-5723	-6	-11	-64	Low	Medium
Silver Line East Extension: S. Station to City Point	6840	1360	-18545	-8940	-11	-13	-137	Low	Medium
Urban Ring Phase II	53000	15000	-163680	-118013	-116	-235	-1313	High	High
Urban Ring: Phase III - Sullivan to Dudley	134700	54600	-620500	-447381	-441	-890	-4976	High	High

TABLE C-12 BUS EXPANSION CAPITAL COSTS AND TRAVEL TIME SAVINGS

Projects	Capital Costs	New Riders	Cap per New Rider	Travel Time Savings (hrs)	Cost per Hour Saved	Cap/CO2	Cap/VOC	Cap/NOx	Cap/CO
Provide Dedicated Bus Lanes Approaching Alewife Station	$340,000	340	$1,000	-58	-$5,913	-$217	-$220,679	-$109,186	-$19,536
Extend Trackless Trolley #71 from Watertown to Newton Corner	$1,500,000	590	$2,542	-65	-$23,196	-$586	-$562,303	-$378,730	-$49,916
Improve Suburban CRR Feeder Bus Service	$7,500,000	1920	$3,906	-208	-$36,058	-$523	-$404,788	$1,443,779	-$36,261
Rte 128 Bus Service Using HOV Lane	$29,000,000	4200	$6,905	625,101	$46.39	$52	$239,669	$193,333	$32,621
Urban Ring Phase 1	$100,000,000	5500	$18,182	-1,388	-$72,046	-$2,412	-$2,439,024	-$1,075,269	-$216,920

TABLE C-13 BUS EXPANSION OPERATING COSTS

Project	New Riders	Average Day Costs	Op Cost/ New Rider	Travel Time Savings (hrs)	Cost per Hour Saved
Provide Dedicated Bus Lanes Approaching Alewife Station	340	$0	$0	-58	$0.00
Extend Trackless Trolley #71 from Watertown to Newton Corner	590	$1,410	$2	-65	-$21.80
Improve Suburban CRR Feeder Bus Service	1920	$28,578	$15	-208	-$137.40
Rte 128 Bus Service Using HOV Lane	4520	$22,441	$5	625,101	$0.04
Urban Ring Phase 1	5500	$100,349	$18	-1,388	-$72.28

TABLE C-14 BUS EXPANSION RIDERSHIP AND AIR QUALITY

Project	Additional Ridership by Mode	New Transit Trips in the System	VMT	CO2 kg	VOC kg	NOx kg	CO kg	Mode Share Rating	Crowding Relief Rating
Provide Dedicated Bus Lanes Approaching Alewife Station	620	340	-2170	-1564.57	-1.5407	-3.11395	-17.4034	Low	Low
Extend Trackless Trolley #71 from Watertown to Newton Corner	840	590	-3760	-2558.66	-2.6676	-3.9606	-30.0502	Low	Low
Improve Suburban CRR Feeder Bus Service	2690	1920	-26180	-14337.2	-18.5282	5.1947	-206.835	Medium	Medium
Rte 128 Bus Service Using HOV Lane	4840	4520	-57270	556120	121	150	889	High	Low
Urban Ring Phase 1	21350	5500	-33000	-41458	-41	-93	-461	High	High

TABLE C-15 COMMUTER RAIL EXPANSION CAPITAL COSTS AND TRAVEL TIME SAVINGS

Project	Total Capital Cost	New Transit Ridership	Cost per New Rider	Travel Time Savings (hrs)	Cost per Hour Saved	Cost per Reduc. CO2	Cost per Reduc. VOC	Cost per Reduc. NOx	Cost per Reduc. CO
Improve Fitchburg Line by Adding a Station at Alewife	$4,065,600	40	$101,640	-3	-$1,219,680	-$25,631	-$26,028,169	-$12,878,049	-$2,304,239
Improve Fitchburg Line: new station on Rt 2 west of 495 in Ayer	$8,200,000	40	$205,000	-19	-$424,138	-$14,216	-$14,436,620	-$7,142,857	-$1,278,055
Extend Line from Fitchburg to Gardner	$104,212,247	50	$2,084,245	-19	-$5,437,161	-$86,191	$20,497,275	$830,003	$71,086,117
Improve Framingham/Worcester Line: new station in Allston/Brighton	$4,065,600	50	$81,312	-18	-$223,794	-$20,885	-$21,208,138	-$10,493,225	-$1,877,528
Operate High Frequency Service: Readville to Allston Landing	$34,288,000	80	$428,600	-71	-$482,930	$12,290	$1,632,762	$92,172	$463,351
Riverside-Backbay-JFK-Umass via Yawkey	$31,473,000	100	$314,730	-44	-$715,295	$10,512	$1,388,470	$76,577	$393,413
Riverside-South Station	$31,473,000	130	$242,100	-27	-$1,165,667	$12,931	$1,573,650	$86,702	$456,130
Improve Worcester Line: new station in Millbury	$7,405,200	140	$52,894	-62	-$118,959	-$2,367	-$2,403,193	-$1,189,036	-$212,752
Improve Fitchburg Line: new station in Union Sq, Somerville	$4,065,600	160	$25,410	-69	-$58,638	-$7,724	-$7,844,106	-$3,881,056	-$694,428
Improve Fairmount Line: new stations and improve frequency	$70,000,000	220	$318,182	-443	-$158,014	$105,105	$7,000,000	$360,825	$2,333,333
Improve Framingham/Worcester Line: new station at Riverside	$10,744,800	250	$42,979	-81	-$133,338	-$3,644	-$3,700,127	-$1,830,725	-$327,567
Extend Line from Middleborough to Wareham	$35,781,346	420	$85,194	-200	-$179,355	-$2,112	-$3,389,284	$392,488	-$205,797
Operate Full-time Service to Foxborough	$71,273,859	630	$113,133	-133	-$535,894	-$6,860	-$6,966,393	-$3,446,787	-$616,726
Build Spur from Salem to Danvers via Peabody	$56,021,064	700	$80,030	-271	-$206,974	-$5,209	-$8,558,976	$917,197	-$509,248
Extend Line from Forge Park to Milford via Bellingham	$70,463,237	757	$93,082	-310	-$227,142	-$3,872	-$5,033,088	$1,761,581	-$363,213
Improve Rockport/Newbury Line: new station in South Salem	$8,200,000	840	$9,762	-102	-$80,392	-$998	-$1,013,096	-$501,253	-$89,688
Extend Line from Providence to T.F. Green Airport	$42,834,000	900	$47,593	-286	-$149,726	-$1,869	-$2,289,425	$1,297,180	-$174,316
Improve Framingham/Worcester Line: new Regional Station at I-495	$111,078,000	910	$122,064	-247	-$449,709	-$5,033	-$5,111,006	-$2,528,790	-$452,471
Extend Line from Wareham to Hyannis	$77,090,746	970	$79,475	-393	-$196,160	-$1,513	-$2,083,534	$464,402	$144,095
Extend Line from Haverhill to Plaistow, NH	$21,780,000	1310	$16,626	-282	-$77,143	-$569	-$621,680	-$966,143	-$51,960
Build Spur from Framingham to Leominister	$375,470,938	1330	$282,309	-587	-$640,098	-$13,067	$57,443,078	$574,855	-$1,585,377
Extend Line from Lowell to Nashua via North Chelmsford	$35,534,000	2210	$16,079	-362	-$98,115	-$562	-$690,447	$377,014	-$52,442
Extend Line from Needham to Millis via Medfield & Dover	$128,800,000	2700	$47,704	-385	-$334,908	-$3,075	-$4,610,406	$685,154	-$296,611
Extend Line from Stoughton to Fall River & New Bedford	$670,000,000	7090	$94,499	-4,273	-$156,814	-$4,843	-$6,062,920	$2,688,268	-$453,410
Construct North - South Rail Link	$8,700,000,000	54350	$160,074	-17,730	-$490,705	-$12,000	-$13,849,482	$28,480,420	-$1,106,806

TABLE C-16 COMMUTER RAIL EXPANSION OPERATING COSTS

Project	Added Daily Cost	New Riders	Op Cost per New Rider	Travel Time Savings (hrs)	Cost per Hour Saved
Improve Fitchburg Line by Adding a Station at Alewife	N/A	40	N/A	N/A	N/A
Improve Fitchburg Line: new station on Rt 2 west of 495 in Ayer	N/A	40	N/A	N/A	N/A
Extend Line from Fitchburg to Gardner	$16,882	50	$337.65	-19	-$880.82
Improve Framingham/Worcester Line: new station in Allston/Brighton	N/A	50	N/A	-18	N/A
Operate High Frequency Service: Readville to Allston Landing	$16,150	80	$201.88	-71	-$227.46
Riverside-Backbay-JFK-Umass via Yawkey	$17,787	100	$177.87	-44	-$404.25
Riverside-South Station	$15,957	130	$122.75	-27	-$591.00
Improve Worcester Line: new station in Millbury	N/A	140	N/A	N/A	N/A
Improve Fitchburg Line: new station in Union Sq, Somerville	N/A	160	N/A	N/A	N/A
Improve Fairmount Line: new stations and improve frequency	$2,800	220	$12.73	-443	-$6.32
Improve Framingham/Worcester Line: new station at Riverside	N/A	250	N/A	-81	N/A
Extend Line from Middleborough to Wareham	$16,466	420	$39.20	-200	-$82.53
Operate Full-time Service to Foxborough	$33,600	630	$53.33	-133	-$252.63
Build Spur from Salem to Danvers via Peabody	$10,875	700	$15.54	-271	-$40.18
Extend Line from Forge Park to Milford via Bellingham	$10,083	757	$13.32	-310	-$32.50
Improve Rockport/Newbury Line: new station in South Salem	N/A	840	N/A	-102	N/A
Extend Line from Providence to T.F. Green Airport	$10,367	900	$11.52	-286	-$36.24
Improve Framingham/Worcester Line: new Regional Station at I-495	N/A	910	N/A	-247	N/A
Extend Line from Wareham to Hyannis	$35,269	970	$36.36	-393	-$89.67
Extend Line from Haverhill to Plaistow, NH	$7,082	1310	$5.41	-282	-$25.08
Build Spur from Framingham to Leominister	$93,651	1330	$70.41	-587	-$159.66
Extend Line from Lowell to Nashua via North Chelmsford	$29,028	2210	$13.14	-362	-$80.15
Extend Line from Needham to Millis via Medfield & Dover	$35,777	2700	$13.25	-385	-$93.03
Extend Line from Stoughton to Fall River & New Bedford	$69,156	7090	$9.75	-4,273	-$16.19
Construct North - South Rail Link	$231,000	54350	$4.25	-17,730	-$13.03

TABLE C-17 COMMUTER RAIL EXPANSION RIDERSHIP AND AIR QUALITY

Project	Additional System Ridership by Mode	New Transit Trips in the System	New Trips causing Auto Diversions	VMT	CO2 kg	VOC kg	NOx kg	CO kg	Mode Share Rating	Crowding Relief Rating
Improve Fitchburg Line by Adding a Station at Alewife	60	40	-40	-220	-159	0	0	-2	Low	Low
Improve Fitchburg Line: new station on Rt 2 west of 495 in Ayer	100	40	-40	-800	-577	-1	-1	-6	Low	Low
Extend Line from Fitchburg to Gardner	50	50	-50	-3,220	-1,209	5	126	1	Low	Low
Improve Framingham/Worcester Line: new station in Allston/Brighton	70	50	-50	-270	-195	0	0	-2	Low	Low
Operate High Frequency Service: Readville to Allston Landing	920	80	-73	-545	2,790	21	372	74	Low	Low
Riverside-Backbay-JFK-Umass via Yawkey	2160	100	-91	-727	2994	23	411	80	Low	Medium
Riverside-South Station	820	130	-118	-945	2434	20	363	69	Low	Low
Improve Worcester Line: new station in Millbury	300	140	-130	-4340	-3129	-3	-6	-35	Low	Low
Improve Fitchburg Line: new station in Union Sq, Somerville	390	160	-150	-730	-526	-1	-1	-6	Low	Low
Improve Fairmount Line: new stations and improve frequency	6480	220	-200	-1400	666	10	194	30	Low	Medium
Improve Framingham/Worcester Line: new station at Riverside	660	250	-230	-4090	-2949	-3	-6	-33	Low	Low
Extend Line from Middleborough to Wareham	1300	420	-380	-25,000	-16,939	-11	91	-174	Low	Low
Operate Full-time Service to Foxborough	790	630	-570	-14410	-10390	-10	-21	-116	Low	Medium
Build Spur from Salem to Danvers via Peabody	1670	700	-640	-15,910	-10,754	-7	61	-110	Medium	Medium
Extend Line from Forge Park to Milford via Bellingham	1830	757	-1530	-26,120	-18,198	-14	40	-194	Medium	Low
Improve Rockport/Newbury Line: new station in South Salem	1140	840	-760	-11400	-8219	-8	-16	-91	Low	Low
Extend Line from Providence to T.F. Green Airport	1520	900	-820	-32,730	-22,915	-19	33	-246	Low	Low
Improve Framingham/Worcester Line: new Regional Station at I-495	1490	910	-830	-30610	-22070	-22	-44	-245	Medium	Low
Extend Line from Wareham to Hyannis	520	970	-880	-73,900	-50,957	-37	166	535	Medium	Medium
Extend Line from Haverhill to Plaistow, NH	1660	1310	-1190	-53,690	-38,245	-35	-23	-419	Medium	Medium
Build Spur from Framingham to Leominister	2980	1330	-1210	-48,420	-28,735	7	653	-237	Medium	Medium
Extend Line from Lowell to Nashua via North Chelmsford	3130	2210	-2010	-90,340	-63,222	-51	94	-678	Medium	Medium
Extend Line from Needham to Millis via Medfield & Dover	4000	2700	-2450	-61,360	-41,881	-28	188	-434	Medium	Medium
Extend Line from Stoughton to Fall River & New Bedford	8700	7090	-6450	-198,200	-138,341	-111	249	-1,478	High	Medium
Construct North - South Rail Link	96100	54350	-49410	-1026600	-724978	-628	305	-7860	High	High

TABLE C-18 FERRY EXPANSION CAPITAL COSTS , OPERATING COSTS AND TRAVEL TIME SAVINGS

Projects	Total Capital Cost	New Transit Riders	Cap Cost/New Rider	Added Daily Cost	Op Cost per Added Rider	Travel Time Savings (hrs)	Cap Cost per Hour Saved	Op Cost per Hour Saved
Restore Service from East Boston to Boston	$3,500,000	70	$50,000	$2,460	$35	-3	-$1,200,000	-$844
Improve Service from S.Shore	$39,670,000	270	$146,926	$66,284	$245	-150	-$263,880	-$441
New Route from North Shore to Airport	$16,287,500	100	$162,875	$12,377	$124	-23	-$723,889	-$550
New Service to Russia Wharf	$4,000,000	50	$80,000	$3,355	$67	-9	-$467,836	-$392

TABLE C-19 FERRY EXPANSION RIDERSHIP AND AIR QUALITY

Project	Additional Ridership by Mode	New Transit Trips in the System	VMT	CO2 kg	VOC kg	NOx kg	CO kg	Mode Share Rating	Crowding Relief Rating
Restore Service from East Boston to Boston	290	70	-320	10.51	13.3028	25.1158	7.8286	Low	Low
Improve Service from S.Shore	760	270	-3630	2297.283	273.0657	515.8235	182.6619	High	High
New Route from North Shore to Airport	350	100	-1640	31.02	66.8956	126.2966	39.1372	Medium	Medium
New Service to Russia Wharf	1000	50	-200	184.75	18.308	34.588	12.571	Low	Low

P M T

APPENDIX D

Public Involvement

PUBLIC COMMENTS

The MBTA actively sought public comments throughout the development of the PMT. Many were received and all have been considered.

Suggestions for capital improvement projects were incorporated into the PMT Universe of Projects. This includes ideas submitted during the earliest outreach efforts until to the development of the preliminary PMT results.

Other types of public comments, such as those on the PMT vision, goals, objectives, project screening, or evaluation process were noted and taken into consideration before developing the final PMT document. Comments received during the January 2003 workshops (where preliminary results were presented) are noted in the workshop summaries later in this appendix. Written comments received by mail, E-mail, or fax during the official public review period for the Draft PMT are also summarized in this appendix. Verbal comments received at the public hearings are recorded in transcripts which may be viewed at the MBTA Planning Department, Room 5750, or at the Central Transportation Planning Staff, Room 2150, State Transportation Building, 10 Park Plaza, Boston.

While most comments were pertinent to the PMT, many referred to operational or policy issues that are not within the document's purview. These were referred to the appropriate MBTA department for consideration.

MBTA Program for Mass Transportation
Public Involvement Meetings, Workshops, and Hearings

The MBTA conducted an extensive public outreach program to contribute to the development of the PMT. The following table lists the meetings at which the PMT was discussed and the PMT workshops and hearings conducted.

Meetings w/ Existing Advocacy Groups and Institutional Organizations	**Date**
Regional Transportation Advisory Council (formerly JRTC)	5/9/01
MassBike	7/13/01
Access Advisory Committee to the T	7/25/01
Alternatives for Community and Environment	7/30/01
Transportation Planning and Programming Committee	8/30/01
MBTA Advisory Board	9/19/01
Metropolitan Area Planning Council	9/19/01
Artery Business Committee	10/9/01
I-495 Initiative	10/17/01
Kennedy School of Government Rappaport Institute	11/2/01
Caravan for Commuters	11/7/01
Association for Public Transportation	12/12/01
MBTA Advisory Board Capital Planning Committee	12/6/01
Regional Transportation Advisory Council	2/13/02
MBTA Advisory Board Capital Planning Committee	8/2/02
Transportation Planning and Programming Committee	12/18/02
Regional Transportation Advisory Council	1/8/03
Access Advisory Committee to the T	1/22/03
MBTA Advisory Board Capital Planning Committee	1/29/03
MoveMass	3/7/03
Meeting w/Existing Groups – Neighborhood/Regional	**Date**
Metropolitan Area Planning Council Subregions	
North Shore Task Force	5/10/01
North Suburban Planning Council	7/11/01
SouthWest Advisory Planning Committee	7/19/01
Inner Core	9/5/01
Minuteman Advisory Group on Interlocal Coordination	9/6/01
South Shore Coalition	9/20/01
Three Rivers Interlocal Council	11/29/01
Regional Planning Agencies Outside Boston	
Central Massachusetts Reg. Planning Commission (Worcester RTA)	7/12/01
Northern Middlesex Council of Governments	Summer/01
Merrimac Valley Planning Commission	Summer/01
Montachusett Regional Planning Commission (Montachuset Area RTA)	8/15/01
Southeast Regional Planning & Economic Development District (Greater Attleboro Taunton RTA) and (Southeastern RTA)	8/22/01
Old Colony Planning Council (Brockton Area RTA)	8/23/01
Other Neighborhood or Regional Groups	
Brighton-Allston Improvement Association	9/6/01

Public Workshops	**Date**
MBTA-Sponsored Workshops – Initial Outreach	
South Suburban Area Workshop – Quincy City Hall	10/18/01
North Side Commuters Workshop – Fleet Center/North Station	10/23/01
North Suburban Area Workshop – Malden Government Center	10/25/01
MetroWest Area Workshop – Framingham Town Hall	10/29/01
Boston Workshop – Roxbury, Dudley Branch Library	11/1/01
South Side Commuters Workshop – South Station – the Federal Reserve Building	11/7/01
Fitchburg Workshop	11/28/01
Wakefield Workshop	12/5/01
Workshops on Preliminary Results	
Boston - State Transportation Building	1/15/03
North - Chelsea Senior Center	1/15/03
West - Framingham Town Hall	1/22/03
South - Thayer Public Library, Braintree	1/23/03
Public Hearings on Draft PMT	
Boston - State Transportation Building	3/5/03
Afternoon – State Transportation Building	3/6/03
PMT Working Committee Meetings	
State Transportation Building, Boston	8/15/01
State Transportation Building, Boston	9/25/01
State Transportation Building, Boston	10/15/01
State Transportation Building, Boston	11/20/01
State Transportation Building, Boston	12/18/01
State Transportation Building, Boston	1/15/02
State Transportation Building, Boston	2/19/02
State Transportation Building, Boston	3/19/02
State Transportation Building, Boston	5/21/02
State Transportation Building, Boston	6/25/02
State Transportation Building, Boston	9/17/02
State Transportation Building, Boston	10/15/02
State Transportation Building, Boston	11/19/02
State Transportation Building, Boston	12/17/02
State Transportation Building, Boston	1/21/03
State Transportation Building, Boston	3/25/03

PMT Working Committee Members

The MBTA convened the PMT Working Committee to provide guidance and advice on the development of the PMT. The members represent a wide variety of public interests and perspectives and include state agencies, municipalities, and community-based organizations.

The Working Committee provided valuable input to the PMT. It reviewed and refined all PMT materials and provided substantive feedback and direction on the goals and objectives, vision, screening criteria, evaluation measures, preliminary results, and public involvement process.

The MBTA appreciates the involvement of all the members. They brought their professional expertise, constructive ideas, and informed, well-reasoned views to the Committee's work.

Members

Access Advisory Committee to the MBTA – Philip Beaulieu, Elizabeth Dillard, James Oliver

City of Boston – Vineet Gupta

City of Chelsea – John DePriest

City of Somerville – Stephen Post, Stuart O'Brien

Conservation Law Foundation – Seth Kaplan, Toni Hicks, Scott Darling

Department of Housing and Community Development – Bill Reyelt

Executive Office of Environmental Affairs – Deirdre Buckley

Executive Office of Transportation and Construction – Astrid Glynn, Todd Fontanella

Massachusetts Bay Transportation Authority – Dennis DiZoglio (Working Committee Chair), Joseph Cosgrove, Stephen Woelfel

MBTA Advisory Board – Paul Regan, Noah Berger

Metropolitan Area Planning Council – Barbara Lucas

ReBuildit Collaborative – Curtis Davis

Regional Transportation Advisory Council – Bill Deignan

Town of Burlington – Eleanor O'Connell

Town of Sharon – George Bailey

Transit Riders Union – Khalida Smalls

Meeting Notes
PMT Working Committee Meeting
August 15, 2001

In Attendance: See attached list.

Meeting Summary

The meeting was the first for the MBTA Program for Mass Transportation (PMT) Working Committee. Members introduced themselves and the Deputy General Manager of the MBTA, Michael Mulhern, provided welcoming remarks and an overview of the MBTA's approach to the PMT. The MBTA provided a detailed discussion of the PMT covering the purpose of the PMT, its characteristics, changes resulting from forward-funding, the relationship to other transportation planning documents, the PMT process, and the role of the PMT Working Committee in guiding the PMT. Working Committee members discussed several matters at length, including issues related to the proposed PMT Vision Statement and discussion points for the Goals and Objectives. Members provided input on issues to be addressed by the PMT as well as the public involvement process.

The following summarizes comments from Working Committee members.

Working Committee Process

The PMT process should coordinate with other ongoing planning processes.

There are concerns about how the committee and the MBTA will work together in the prioritization process.

The MBTA should meet with the Subregions twice; first to present the projects and later to gather ideas and input.

Use the web to circulate and share information and comments. The committee should exchange information on an email list-serve.

There is value in the Working Committee learning and talking about information as a group, not just by picking up information from the Web site.

The committee should get out into the areas where there are issues (it may mean meeting on a bus/boat/or train) so that people can understand the issues.

Bring in third parties not typically involved in transportation to provide new perspectives, for example, on alternative financing.

Each meeting could focus on a theme, with the MBTA bringing in information, postulating a case, etc.

The committee may want to self-select into interactive sub-groups.

PMT Considerations

Note which project ideas are legally required projects.

Part of the committee's job will be the difficult task of balancing fiscal constraints with "wish-lists".

The committee should be aware of constraints, but should also consider whether a project can be funded by another entity or through another mechanism.

Some of the bus projects listed are already underway and shouldn't be included in a long-range vision document.

The committee should encourage the MBTA to aggressively advocate for public transit, particularly by working with the Massachusetts Congressional delegation seeking funding for programs prioritized in the PMT.

The committee is going to have to prioritize projects and develop trade-offs with an awareness of the MBTA's limited resources.

There should be a discussion of financial issues with input from MBTA financial managers and financial experts from the private sector to get ideas for possibilities for attracting additional private capital.

Should the MBTA shoulder the burden of assuring transportation mobility options equally to all or for those who have limited resources and options on their own?

Two local organizations, the Transit Riders Union (TRU) and Alternatives for Community and the Environment (ACE) can define Environmental Justice (EJ) and work with the committee to integrate it into all elements of the system.

Availability of Information

Committee members should be familiar with earlier PMTs.

The committee should look at the statute that provides goals for the MBTA (e.g. maximize revenue) and the new goal of balancing benefits and burdens (EJ).

Committee members should provide information they want to share with the whole committee. (MBTA Advisory Board, ACE, TRU have volunteered information.)

The committee should be provided specific background information, including information on: the existing system, constraints and congestion in the existing systems, vehicles and fleet, alternative fuels, relative costs per passenger mile, current census data, build-out analyses, EJ definition and measures, the existing PMT, lists of our legal commitments and requirements, the Capital Investment Program (CIP) and CIP criteria.

Input for the Vision Statement and Goals and Objectives

Maintenance is important, but the committee should not be precluded from comparing proposed new with existing service.

Provide a definition of maintenance of existing infrastructure.

There is an opportunity to change maintenance through capital investment. By changing the infrastructure, the maintenance of a portion of the system changes. (Example: if the MBTA establishes a maximum average age for the bus fleet, maintenance needs will change.)

Specifically, add the word “desirable” before “quality of life” in the third bullet; and in the last phrase, add “sustainable” prior to “communities”.

The vision and goals and objectives should have a value-based perspective.

Mobility and improving access to the existing system should be part of the vision and goals and objectives.

Examples of projects advancing this vision are shuttles, additional parking, pedestrian walkways, bicycle facilities.

Define what is meant by “protecting the environment”. The vision should be “improving” the environment.

The MBTA should support economic development that works with the system and helps further the goals of the system. The committee needs to discuss the concept of “sustainable development”.

Public Involvement

Project materials should show people the project ideas that have already been suggested.

Working with large maps (and in small groups) is a good approach and should keep people focused on the product.

It is a good idea to arrange discussions with groups at their normally-scheduled meetings.

Action Items

- The next agenda will include discussion of: the PMT vision, draft goals and objectives, information on the documents requested by the committee, upcoming public forums.

- At other meetings, the MBTA will provide briefings on:
  - CIP and the relationship among the MBTA planning documents and the PMT.
  - Congestion management
  - Environmental Justice
  - Financing/Alternative Financing.

- The MBTA will provide background information for the committee, specifically on: the existing PMT, CIP, EJ Definition and Measures, Congestion Management Study, Forward-funding legislation.

- The MBTA should provide information in print and electronically.

- CTPS will set up a list-serve for information exchange among committee members.

- CTPS will post available background documents on the PMT Web site.

- Working Committee members should bring to the committee any information they think pertinent and useful. TRU will bring a Definition of Environmental Justice and some examples.

- The Working Committee will meet monthly, generally on the third Wednesday of each month.

Meeting Notes
PMT Working Committee Meeting
September 25, 2001

In Attendance: See attached list.

Meeting Summary:

Dave Carney, MBTA Operations, provided a detailed presentation of the MBTA system, fleet and facilities, discussing each of the rail lines, including miles of track, routes, vehicles, stations, garages, ridership, and service characteristics for light and heavy rail, commuter rail, bus and boat. Future service and facilities were outlined, as were plans for CNG-fueled buses, dual mode buses, electric-powered trackless trolleys, and “clean diesel” vehicles and automatic fare collection systems. Other services discussed include the Office for Transportation Access for disabled customers and private carrier bus services. He also summarized MBTA revenues and MBTA coordination with TMAs in the region. (Please see the meeting handout.)

Steve Berrang, MBTA, discussed the MBTA Capital Investment Program and the MBTA definition of State of Good Repair. He discussed MBTA investments in infrastructure, enhancements, and expansions and the projected funding required for the various MBTA programs. He discussed the concepts of State of Ideal Repair (like-new operating condition) and State of Good Repair (without unreasonable limitations on ability to perform and provide service) and the investments required to achieve each. The MBTA is pursuing the State of Ideal Repair. They have developed a data base and program that can be used to understand the status of MBTA inventory and the broad, service consequences of various investments. It is used to inform MBTA decision-making on capital investments. He announced upcoming public hearings on the Capital Investment Program and approval process. (Please see the meeting handout.)

Additional topics discussed included, the PMT Vision statement, Goals and Objectives, schedule of PMT tasks, and public participation activities. (See meeting materials.)

The following summarizes comments from Working Committee members.

The MBTA System

The MBTA needs to ensure that existing routes and services (which may parallel private TMA services) are maintained. The private TMA’s services may reduce demand for public bus service and therefore undermine the public service. (If federal funds support a TMA service, they must take public fares.) (The TMAs often provide niche services.) (The individual TMA services in an area could be consolidated, combined and marketed as a single entity.)

PMT discussions should include MBTA plans to implement projects to which it is obligated. If such projects are not going to be completed on deadline, the MBTA should plan for substitutions.

Capital Improvement Programming

The PMT Working Committee should consider what internal, MBTA “structure” can be used to insure that new technology is effectively implemented.

Increasing system capacity is an issue to be addressed.

The definition of “serviceable life” should be more that “start up and roll”. It should be an indicator of the quality of the environment in the bus. When considering what must be done to extend the useful life of a bus, there should be indicators considered that include, for example, the status of the air conditioner. There should be a quality of service index including these broader issues. This is important from an environmental justice point of view. There should be a future presentation on the MBTA standards defining a “serviceable vehicle”. There should be a mechanism for setting competitive standards for vehicle condition when customers do not have other transportation options. The PMT Working Committee should be discussing the MBTA values. Customer dissatisfaction affects the system.

Age is not an adequate tool for judging serviceability. Information on the actual condition should be considered.

Vision

Suggestions for changes to the vision:

Add, “Reduce the state’s environmental impact by transporting people in an efficient manner while supporting the sustainable development of communities.” (No consensus to adopt.)

Revise to read, “Transport customers in a system that preserves and improves the quality of the environment throughout the MBTA District.” (Consensus to adopt.)

Add reference to efficiency. (No consensus)

Add a new bullet or combine with second bullet, “Provide attractive, competitive, reliable transportation option that is competitive with private vehicles.” (No consensus)

Add language on, “…maintaining existing infrastructure in a state of ideal repair.”

Goals and Objectives

Add mention of safety. (consensus)

Add language on meeting projected system ridership demand, such as, “Increase ridership in the most efficient manner to meet future demand.” (consensus)

Discuss long-range projections for ridership at a future meeting (consensus)

Increasing ridership is one mission and a core value of the MBTA.

Add a bullet, “Increase ridership on the system.” (consensus)

Add to #2, “…now and in the foreseeable future.” (consensus)

PMT Working Committee members should be looking beyond the current system to envision an ideal system, unconstrained.

Add to #2, first bullet, delete “new” and replace “developments” with “centers” (consensus)

Add language that identifies a target date for achieving the state of good repair and other higher levels of repair.

Add language stating that the MBTA will meet all projected demand for service.

Add an objective stating the MBTA’s goal to reduce greenhouse gas emissions from its operations.

Schedule of Tasks

The results of the modeling of project sets should be used to identify a more complete list of projects for the PMT universe of projects.

The PMT should be a capital planning tool and a policy document with the policies from the Regional Transportation Plan as a basis and guidance for the evaluation of PMT projects.

The Working Committee should be able to identify new ideas for projects.

The Working Committee may be most useful implementing existing ideas, ideas already on the table.

Screening should include two assessments; one for project-level screening and another for policy-level screening from the RTP.

Action Items

- Continue discussion of MBTA/TMA interactions at a future PMT Working Committee Meeting, including exploration of other Massachusetts RTA/TMA relationships.
- Provide additional information on MBTA standards for a "serviceable vehicle" and the qualitative information considered in this decision-making.
- MBTA will propose revised language for the Goals and Objectives on: additional discussion of ridership and capacity; to #2, "…now and in the foreseeable future"; to #2, first bullet, delete "new" and replace "developments" with "centers"; and a statement of the MBTA's goal to reduce greenhouse gas emissions from its operations
- PMT Working Committee will meet the third Tuesday of every month.
- Other future topics include: in October, Environmental Justice and the Finance Plan, in November, Access to Jobs and the Service Plan, in December, modeling.
- Working Committee members may continue their discussions on the new PMT list serve at: PMT@ctps.org.

Meeting Notes
PMT Working Committee Meeting
October 15, 2001

In Attendance: Please see attached list.

Meeting Summary:

Call to Order

Dennis DiZoglio, Director of Planning, MBTA, called the meeting to order. Working Committee members introduced themselves.

Vision and Goals and Objectives

D. DiZoglio explained that the current version of the Vision and of the Goals and Objectives was revised to respond to the comments raised by members at the last Working Committee meeting. One suggestion, made by Dierdre Buckley, EOEA, was not incorporated, because the MBTA had concerns that it wished to discuss with the Working Committee. The issue is the suggestion to include as an objective the reduction of "greenhouse gases". The MBTA said that it shares this objective, but has a concern that adopting this objective would conflict with the MBTA's current plans to upgrade its bus fleet with Compressed Natural Gas buses (CNG), which reduce particulates and other emissions related to diesel fuels, however, it does not change the fleet's impact on "greenhouse gas" emissions.

Members' Suggestions and Comments:

Members did not feel that the two objectives would be exclusive of each other, and that considering the long-range nature of the PMT, adopting this objective would not preclude the acquisition of CNG buses. The proposed "greenhouse gas" reduction objective is a long-range value to be pursued over the long-term by the MBTA.

Members suggested inclusion of the greenhouse gas reduction objective, and concurred with the MBTA suggestion to include narrative explaining that CNG fueled vehicles are a "bridge" technology helping to improve air quality until other technologies are further advanced.

Members agreed to language replacing "State of Good Repair" with "State of Optimal Repair", in which the MBTA would strive to do more than simply maintain equipment; it would seek to keep it functioning like new.

Changes in the Vision statement were discussed. Regarding the proposed language, “increase transit mode share”, members preferred the language “increase ridership” as more clear and direct. Members suggested using the language, “increase transit ridership”.

Evaluation Criteria

The proposed Evaluation Criteria and their relationships to the Goals and Objectives were discussed. The MPO policies, and other qualitative measures from the proposed PMT Evaluation Criteria, are being considered as the initial screening tool for identifying 60 to 70 projects from the Universe of Projects for inclusion in the PMT. The complete set of criteria in the proposed Evaluation Criteria will be used for prioritization. Projects included in the PMT will be prioritized into high, medium, and low categories. Some criteria are quantitative and some qualitative. The Utilization and Effectiveness categories will be more quantitative. The Service Quality, Economic and Land Use Impacts, and Environmental Justice categories will be more qualitative. Additional, quantitative information on many projects will be provided and used in the evaluation.

Members’ Suggestions and Comments:

Under Utilization, revise the language of the fourth bullet to read, “Impact on mode Share to Downtown Boston and other key trip destinations”. This would recognize the demand for travel to other destinations than Downtown Boston, while recognizing the importance of Downtown Boston.

Under Effectiveness, add a bullet to discuss increasing capacity by increasing the number of non-peak direction/hour trips.

Under Economic and Land Use Impacts, add a bullet discussing reverse commuting needs.

Evaluation Criteria should guide the MBTA towards an effective transit system.

Under Environmental Justice, change the first bullet to, “Does the improvement serve or negatively impact a minority or low income neighborhood?”

The Evaluation Criteria are not pertinent to all types of projects. Projects should be organized by function or category, and appropriate criteria applied.

Areas which are more densely populated should have more service than less populated areas, so there should be an additional criterion under Utilization which focuses on how well a project serves a densely populated area. This is different from the concept of supporting transit-oriented development.

Evaluation Criteria should not “double-count” for particular project characteristics.

Make economic and land-use assumptions more specific.

An initial screening should be done to identify a basic starting-point list of projects, which would include projects that have been past commitments, or that have been considered for many years, or that have significant community support.

Substituting the wording "minimization of transfers and transfer times" would be a more realistic objective than "elimination of transfers".

Add a bullet on reducing "greenhouse gases" in the Air Quality section, and refer to the new EPA standards for fine particulates.

The PMT analysis, in all but the later stages, should focus on quantifiable needs and good transportation policy, rather than on a community's "wants".

Public Participation Update

The Workshop schedule and methods for promoting attendance were discussed.

Members' Suggestions and Comments:

Involve the MBTA Advisory Board to a greater extent in the PMT development process.

There are not enough opportunities to discuss the PMT at suburban venues.

Web Site Update

The list-serve is in operation.

Project Ideas – Working Committee Members

Members were invited to submit their ideas for projects to be considered in the PMT.

Members' Suggestions and Comments:

Boston is developing a city-wide transportation plan and will share with the Working Committee and the MBTA the list of capital projects that emerge through this process.

Compile a list of projects the MBTA is committed to undertaking.

We need to use a model to identify unmet needs

Create a Suburban Ring, using Route 128 for an intermodal transit corridor. Drivers would park in garages within the Route 128 right of way to access a dedicated HOV lane for buses from Route 128 to radial routes. The Route 128 bus lane suggested in the most recent PMT may serve as an initial starting point for concept development.

Consider ITS and other forms of new technology in the PMT.

Action Items

- In the Goals and Objectives, replace "State of Good Repair" with "State of Optimal Repair", in which the MBTA would strive to do more than simply maintain equipment; it would seek to keep it functioning like new.
- Use "redline" process when revising documents which will be the subject of additional review by the Working Committee.
- In the Vision, replace "increase transit mode share" with "increase transit ridership".
- Projects will be organized into clusters of similar projects for evaluation.
- Add a criterion under Utilization which focuses on how well a project serves a densely populated area.
- Make economic and land use assumptions more specific.
- Under Utilization, revise Mobility Enhancement to more specifically ask whether a service is filling an un-met need, such as off-peak hour work trips and reverse commuting.
- Conduct an initial screening to identify an initial list of projects and to include projects that have been past commitments or have been considered for many years.
- Continue discussion of the suggested criterion on community support on the Working Committee's list serve.
- Arrange a meeting of the MBTA Advisory Board Planning Committee and the Working Committee.
- Spice up flyers announcing workshops in order to induce participation.
- Pass out flyers to commuters enough in advance that they can plan their attendance ahead, probably in the morning commute.
- Consider providing additional opportunities for suburban citizens to discuss the PMT.
- Post list of project suggestions on the Web site.
- Working Committee members may continue their discussions on the new PMT list serve at: PMT@ctps.org.
- Compile a list of the projects the MBTA is committed to undertaking.
- Schedule a future briefing from CTPS modeling staff to discuss results of the Regional Transportation Plan modeling work.
- Add a project idea that proposes Route 128 HOV transit (bus) lane providing parking at access nodes and serving radial lines.
- Add a project idea for a Route 128 multi modal/transit lane.

Meeting Notes
PMT Working Committee Meeting
November 20, 2001

Meeting Summary:

Call to Order

Joe Cosgrove, Deputy Director of Planning, MBTA called the meeting to order. Working Committee members, project team and guests introduced themselves.

Public Participation

The MBTA reported to the Working Committee on the public workshops conducted by the MBTA to date. The attendance has been good. Citizens and customers have submitted many ideas and comments. Citizens are pleased with the format of forums. It allows for more constructive, interactive dialogue which seems to be very productive. There will be two additional workshops: one in Fitchburg on November 28th and the last in Wakefield, in collaboration with MAPC, on December 5th.

Several hundred comments and ideas have been submitted. Some come from the workshops, some via the internet, and some are generated by the newsletter. The project ideas that are submitted are posted on the PMT Web site, which is updated every week.

After December 5th, the intensive public outreach phase will be completed. The project will continue to meet with groups, if requested, and will work closely with the MBTA Advisory Board, particularly with its Capital Planning Committee. The next phase of the project will involve screening and evaluating projects.

Addresses and email addresses are collected for our mailing list. The second edition of the PMT newsletter will be published sometime in January.

Members' Suggestions and Comments:

Ideas generated by the Regional Transportation Plan outreach process should be incorporated into the PMT Universe of Projects. The results of planning efforts by MPO entities should be shared and coordinated.

Citizens have found the workshop format to be useful.

The MBTA should respond to comments in a way that demonstrates to citizens that their comments have been heard.

The Web site should include a Frequently Asked Questions (FAQ) section. This would show citizens that their comments have registered with the project. The list could also indicate how many times the comment, suggestion, or issues have been raised. Citizens can get an understanding of the ideas that others are raising. This could be very useful and educational.

Indicate when the site was last updated.

The PMT should be included on the MBTA's Web site and linked to the PMT home page at CTPS.

Update on PMT Schedule

The December Working Committee will focus on a CTPS discussion of transportation demand modeling, which is the project's mechanism for developing ridership estimates. The discussion will provide background information for the screening work that the Committee will review at its January meeting. In January, the MBTA will present its draft list of recommended projects to undergo in depth analysis in the PMT. The pre-screening criteria will be posted for members to review prior to the January meeting. Also included in the January agenda will be a discussion of Environmental Justice. The MBTA will ask Ms. Smalls, of ACE, to contribute information for the discussion. A discussion of the MBTA budget will be scheduled for March. The final list of projects and their general ranking is still scheduled for completion in late spring 2002.

The pre-screening will be guided by the Regional Transportation Plan policies and other qualitative criteria (such as community support), not by the evaluation criteria being discussed by the Working Committee.

The MBTA also thanked Working Committee members Bill Reyelt and Peter Abair for their participation in the PMT work now underway to identify evaluation criteria related to economic development and land use impacts.

Members' Suggestions and Comments:

The Working Committee should discuss the pre-screening criteria prior to the MBTA's completion of its draft list of recommended projects.

It is unclear how some projects will be defined.

The Working Committee should discuss the process for dealing with projects that are very conceptual and not well developed.

It is very difficult to have an accurate understanding of “community support” for a project.

The PMT should look at the land use impacts of transportation decisions. There are many tools available for this kind of analysis.

The PMT should have quantitative measures for evaluating environmental justice issues and projects, particularly measures for understanding which projects will most improve transit connections between highly transit-dependent neighborhoods and employment destinations.

Evaluation Criteria

The Evaluation Criteria have been modified to reflect changes suggested by Working Committee members. Changes from the initial draft were noted, particularly in the section discussing mobility and the section on economic land use impacts. Commitments to air quality measurements should be reexamined based on available resources for analysis. One new item calls for review of a project’s consistency with existing economic development, transportation or land use plans. Another new item examines whether a project would improve access to higher density neighborhoods, which reflects members’ desire to give preference to projects that would serve existing high-density residential and employment areas. Another item asks if a project supports development of a Brownfield site. Revisions to the Environmental Justice section were noted. A reference was made to the North Shore MIS. The MIS schedule is not concurrent with the PMT schedule and will not yield a list of recommended projects for the PMT prior to completion of the PMT. If the results of the MIS are not consistent with the PMT, the PMT can be amended.

Members’ Suggestions and Comments:

An item that was missed was consideration of whether a project would create a negative impact on low income or minority neighborhoods.

The MBTA should improve signage showing passengers bus routes.

Regional and local planning efforts are sometimes at odds.

Add a new item which provides that projects that contribute to sustainable development and transit-oriented development are viewed more favorably.

The PMT should consider the goals and objectives of local planning to get a sense of a project’s consistency with them.

In the third bullet on mobility, use of the word “currently” is redundant.

Regarding air quality, emissions of fine particulates and carbon dioxide can be determined and might now be projected for the future, particularly considering new low sulfur fuel requirements. Fuel economy is not always a measurement of "greenhouse gas" reduction.

Vehicle miles traveled may be one of the best measures of emission reductions, particularly since this might be a way that transit and highway projects can be compared.

Change references to "cost effectiveness" to "cost".

Measuring and evaluating are two different exercises.

The definition and limits of some projects need additional description. Are phased projects and independent project components measured and compared with other projects in phases or as a whole?

The previous PMT used capital cost/new rider as a measure.

The PMT should consider a project's impact on the transportation network.

The PMT should not automatically omit projects that are in conceptual stages and not well-defined. This would allow the PMT to more accurately reflect the region's vision for the future. Project definition should not be a pre-screening criteria.

Local and regional plans should be reviewed separately.

Define the following terms: state of optimal repair, mode share, and major employment center. Include the definitions on the first page on which the term is used.

Traffic congestion is not going to go away, as long as the region is economically prosperous.

Regarding travel time, what is important are the kinds of transportation choices available to travelers.

Anxiety, while a factor of service quality, is very difficult to measure.

Members are encouraged to continue their discussions on-line on the PMT list-serve.

MBTA Service Planning

David Carney, MBTA, discussed the proposed changes to the MBTA Service Plan. The MBTA recently held nine community workshops and two public hearings on the preliminary 2002 MBTA Service Plan. It proposed changes to approximately 70 different routes. It is guided by the MBTA Service Delivery Policy which includes the criteria that

the MBTA uses to evaluate service. The objective of making these changes is to put MBTA resources to the best possible use, therefore increasing overall service. The Service Plan discusses major changes to service. Minor changes are implemented quarterly as slight adjustments. The proposed changes were summarized and informational materials, showing changes by route, were distributed. Comments on the 2002 Service Plan are due by the end of November.

Members' Suggestions and Comments:

It would be interesting to understand why the service to Logan was not utilized.

There seem to be two main considerations in service planning: the resources and the demand for service.

Consider whether some of the service planning suggestions might be useful in the PMT.

Job Access and Reverse Commute

There are both federal and state initiatives underway. There are three primary sources of funding: U.S. Department of Labor Welfare to Work funds (improving transportation information given by job counselors), Job Access and Reverse Commute FTA grants (to start some new transit services), and funds available through the Department of Transitional Assistance's Interagency agreement with the Executive Office of Transportation and Construction (for transit passes, transportation coaching, and funds to provide transportation to work sites where no transit is available). The FTA grants might fund new transit services in newly identified origin/destination pairs where there are no service links. The MBTA has received funds for several new bus services: the CT-3 route providing service from Andrew station to Logan Airport; early morning (starting at 3:00 AM) service to the airport from Mattapan, Ashmont and Dudley stations; "sunrise services" to Downtown Boston from Watertown Square, Jamaica Plain, Ashmont, and Hyde Park; and routes to suburban shopping centers.

Action Items:

Incorporate ideas from RTP outreach into the PMT Universe of Projects.

Demonstrate to citizens that their comments have been heard.

Create a FAQ section on the Web site.

Add a note to the Web site indicating the date that the project listing was last updated.

Add the PMT to the MBTA Web site.

Discuss how projects that are very conceptual and not well developed will be considered for inclusion on the draft list of recommended projects.

The PMT will consider air quality projections for fine particulates and carbon dioxide, if they are available.

Discuss performance measures and ways to define projects at the January Working Committee meeting while reviewing the draft recommended list of projects.

Define the following terms: state of optimal repair, mode share, and major employment center. Include the definitions on the first page on which the term is used in the PMT final report.

Meeting Notes
PMT Working Committee Meeting
December 18, 2001

In Attendance: Please see attached list.

Meeting Summary:

Call to Order

Dennis DiZoglio, Director of Planning, MBTA, called the meeting to order. Working Committee members, project team and guests introduced themselves.

Copies of the Consent Order for the Central Artery project were made available for members.

Public Participation

There were two additional public workshops since the last meeting; one in Fitchburg, and one in Wakefield (held in conjunction with MAPC). The initial outreach phase for the PMT has now been completed. While the project team will continue to meet with organizations upon request, the PMT Working Committee will be the focal point for public involvement in the upcoming phase.

A Frequently Raised Comment section will be added to the PMT Web-page. There will be a new edition of the PMT Monitor published early in the new year.

The MBTA is reviewing the Capital Investment Program (CIP) with the Transportation Planning and Programming Committee and the MBTA Advisory Board in the near future.

Information from MBTA departments on future needs in the MBTA system is now being gathered. Projects to meet these needs will be considered in the PMT. The CIP includes information that citizens will find useful in understanding long term needs.

Members' Suggestions and Comments:

- The MBTA should give the PMT Working Committee members copies of comments received (since January 2001) on the Regional Transportation Plan.
- There is concern that public involvement activity on the MBTA Service Plan and the PMT have detracted from citizens' commenting on the CIP. It is not getting media coverage. Assertive outreach will help. While the CIP is on the Web-site, it is not easy to find. The Advisory Board is concerned about getting good public involvement in the CIP.

- The CIP should be a good indicator of MBTA thinking, both short and long term. Short term projects are sometimes indicators of future trends and needs.
- The PMT pre-screening criteria should be related to the CIP criteria.
- The MBTA views and ideas for the system should be explicitly identified. There may be large differences between the PMT vision and the CIP.
- Members have not received a copy of the CIP/State of Good Repair presentation.

Review of Evaluation Criteria

Most comments from members have been incorporated into the revised December 5th Performance Measures. CTPS staff has been consulting with DEP to identify local capability in measuring carbon dioxide emissions and fine particulates, and so this request has not yet been incorporated.

There is no plan for quantifying all the criteria. They will not be used as part of a scoring system, but more informally, as a way to get a sense of how projects rate on a scale of 1 to 5. They will be used as a way of seeing if the particular project meets the goal of the criteria well and then comparing projects, considering all the criteria.

Suggestions raised at this meeting will be incorporated into the performance measures.

Members' Suggestions and Comments

- Add an item on improving mobility for the transit dependent user.
- Add an item on non-motorized access There should be a measurement for understanding the dollar value (considering increased opportunities for non-motorized access) of locating stations in existing activity centers so that planners can better compare costs of various proposed station locations.
- Potential sites in activity centers are often already used for other than transit purposes.
- Attempt to quantify all the criteria so as to maintain their usefulness in the screening process. Use an objective way of measuring how well a project meets the criteria.
- Expanded descriptions could be useful in instances in which the criteria can't be quantified.
- In comparing cost to benefit, look at total cost (including operating cost, perhaps annualized), not just capital cost.
- The PMT should encourage development consistent with local plans.
- The PMT should be based on development that is already in place in a community, not future plans.
- Regarding land use, the criteria should consider state designated revitalization areas, which are previously developed areas.
- It is important to look at the underlying criteria for designation.
- The evaluation criteria should ask, Does the project spur transit-oriented development?
- The Urban Ring Compact document will provide useful perspectives for this evaluation.

Future Needs Assessment and Travel Demand Modeling Techniques

CTPS staff discussed the CTPS travel demand model and its use in the PMT for developing ridership estimates, travel time benefits analyses, and air quality analyses. The model is multi-modal and includes 90% of all the current transportation facilities and services, including highway and all modes of public transit. Local transit authorities and private shuttles are not in the model. It has been updated to forecast walk trips and has a mode choice model. The model provides very satisfactory forecasts. For air quality, the model can calculate carbon monoxide, volatile organic compounds, and nitrous oxides. CTPS is exploring possible ways to calculate carbon dioxide.

For the PMT, the model will begin with a base case, all the projects believed to be completed by 2025 (projects in the Regional Transportation Plan). Then transportation statistics will be developed. Then, CTPS will model future conditions with proposed projects in place, showing projected benefits. The model can show multi-modal impacts. Model runs will look at the impacts of several projects (with no synergistic interaction) at a time. Current, but not future, emission factors for transit vehicles are included in the model. Assumptions of future fleet mix for buses, assuming the use of known technologies, allows for calculation of future bus fleet emissions. The current model does not have a land use component.

CTPS staff discussed the results of the analysis conducted for the Regional Transportation Plan and showed mapping of the highway and transit corridors projected to be congested. The CTPS analysis considered two land use scenarios, Trends Extended (assuming growth in population and employment will follow similar pattern as the past) and Targeted Growth (assuming growth occurring in areas with existing water and sewer infrastructure). Job growth in the region will outpace housing growth, so, most housing growth is projected to occur outside the region. Projected percentage increases in trips and projected ridership by mode was discussed. The bulk of new trips will be auto trips. However, for new trips, the transit trips and walk trips will have a greater percentage increase and auto trips will show a percentage decrease. Commuter rail will experience the highest percentage increase of all transit modes. Vehicle trips increased less than miles per vehicle trip. Projections also show transit services at- or over-capacity. The highest increase in highway congestion will occur in the outer areas. Projections for both transit and highway show where demand will exceed capacity.

Members' Suggestions and Comments:

- Modeling results must be impacted by subsequent development.
- Please define the transit service characteristics in the model.
- Targeted growth scenario assumes that population will grow in areas with existing infrastructure and resources.
- The volume/capacity ratio is particularly pertinent to PMT considerations.
- Add Scenario C to the tables.
- The Urban Ring best addresses the Green Line crowding problem.

- When the projects for the Regional Transportation Plan have been finalized, will that affect the base case for the PMT? Planning will be more coherent when the RTP and the PMT cycles are synchronized.

Action Items:

- Make copies of the Regional Transportation Plan comments available to the Working Committee
- Provide members a copy of the CIP/State of Good Repair presentation.
- Add an item on improving mobility for transit dependent users to the performance measures.
- Expand the discussion in the Interconnectivity bullet to specify interest in pedestrian and bicycle access.
- The Department of Housing and Community Development will develop material discussing general characteristics of state designated revitalization areas.
- Add a bullet that asks if the project spurs transit-oriented development.
- Incorporate all suggestions into the revised performance measures.
- Clarify whether the PMT base case/no-build will be modified to include the final set of projects in the Regional Transportation Plan.

Meeting Notes
PMT Working Committee Meeting
January 15, 2002

<u>In Attendance</u>: Please see attached list.

<u>Meeting Summary:</u>

I. Call to Order

Dennis DiZoglio, Director of Planning, MBTA, called the meeting to order. Working Committee members, project team and guests introduced themselves. Copies of all comments submitted on the Regional Transportation Plan are available to Working Committee members.

II. Access Boston Study Recommendations – Vineet Gupta

Vineet Gupta discussed the Access Boston Study, a city-wide transportation study. The goal of the study is to identify the city's transportation needs. Public transportation is a particularly important element of this study. The study sets out goals and discusses funding needs and constraints.

The study also points out a set of existing and new projects and suggestions which have emerged from the city's outreach through community meetings and focus groups, such as the Urban Ring, an expanded Silver Line, Fast Track Rapid Rail. Based on these ideas, the city has identified a need for Next Generation Studies, to further explore which of these projects are best suited for the Boston area, over the long-term. The Hinge Block Connector is an important concept the city would like to raise for public discussion. This would involve several alternatives for using the Tremont Street tunnel (now proposed for use by the South Boston Transitway) and varied vehicle types to create east/west connections or extensions in service (such as Fenway area to South Boston Waterfront or to Logan airport). Other concepts for additional study would be identifying interceptor stations along I-495 or Route 128, and looking at new Blue Line extensions.

Joe Beggan, Rizzo Associates, discussed specific details of the study's results. The study identified projects that would help the city achieve its transportation goals by building on the Silver Line's Bus Rapid Transit mode. Potential options might be to extend BRT service and provide additional service to Mattapan, Ashmont Station, South Boston Waterfront, or JFK/UMASS. Another option would use the Massachusetts Turnpike and local streets to bring BRT service to the Allston/Brighton area. A next step could be to examine existing rights-of-way and identify potential rights-of-way as Transit Priority Corridors for providing services.

Fast Track Rapid Rail is a concept that suggests using the Fairmount Branch and Framingham/Worcester commuter rail lines to support new, more frequent services and services to new intermediate stations, perhaps using diesel rail cars.

The results of the study will provide input and serve as the basis for the city's recommendations for projects in this and the next PMT. The city recommends adding all the Access Boston projects to the PMT Universe of Projects and also suggests the PMT consider system concepts as well as specific projects.

Members' Suggestions and Comments:

- Implementing transit priority lanes throughout the metropolitan area is a legal commitment.
- The Urban Ring is a system.
- One way to make the Hinge Block work better would be to explore using the existing tunnel infrastructure, such as the pedestrian link between Park Street and Downtown Crossing and other tunnels now used for storage, instead of using the Essex Street connection.

III. Preliminary Results of Pre-Screening Process

The Working Committee began review of the Prescreened System Expansion Project Listing. Projects listed have been screened, with those to be included for more detailed analysis given checks. After further analysis, these projects will then be given either high, medium, or low priority. Enhancement projects and state of good repair projects will be prescreened after the system expansion projects. (System expansion projects take the system to places it doesn't currently serve and enhancement projects make the system serve existing areas and customers better.)

One item in the project listing is to expand feeder bus service. Some specific feeder bus services are not included because they may be better provided by another transit authority or may be better explored in the service planning process. TMA's should be considered as well. Additional parking is considered in the enhancement category. Projects considered in the North Shore Major Investment Study are included.

Members' Suggestions and Comments

- Make sure you adequately consider feeder buses and jitneys. View it as an extension of the commuter rail service, not just a local bus service.
- Provide a map of RTA service in the MBTA service area.
- We need a better definition of MBTA responsibility for feeder service to commuter rail and the approach for this project.
- Feeder bus service should be considered as part of the PMT, not just the service plan.
- Think of a larger MBTA role, as not just an operating agency, but a planning and coordinating agency that can facilitate benefits beyond its boundaries. It could use its

funds to leverage other funds for acquisition of needed vehicles that might be operated by other entities.

- The MBTA should take responsibility for disseminating information on transit services and connections.
- There should be information provided in the PMT explaining the reasons a project is not included on the list for further evaluation.
- Projects might be grouped by corridor instead of by mode.
- Some Working Committee members feel they have not been given enough information to fully understand and agree with the screening process.
- Insert the Access Boston Blue Line extension proposal.
- Add the Hinge Block Connector.
- For Fairmont Line, revise description to allow consideration of light rail or diesel rail cars as well as heavy rail.
- Group together projects that are mutually exclusive.
- Consider using Electrified Multiple Units and Diesel Multiple Units. The MBTA should be able to maintain multiple types of equipment, such as EMUs. FRA mandates, such as those restricting this technology, should be addressed.
- Add trackless trolley or light rail service in the Broadway, South Boston corridor.
- Include a Washington Street Corridor project providing service from Dudley to Park Street. Model both service to Dudley Square and service to Mattapan.
- The MBTA should encourage additional residential housing at the South Weymouth Naval Air Station.
- System expansions should be described in such a way as to allow consideration of a variety of modes.
- Add the Environmental Justice proposal for 100 additional buses.
- Add BRT, rapid transit, or commuter rail to Union Square.
- Add a Blue Line/Green Line extension to West Medford.

IV. Action Items:

- Provide a map of RTA service in the MBTA service area.
- Better define how improvements and expansions of feeder bus services will be approached.
- Add the following projects to the list of projects for further evaluation: Access Boston Blue Line extension proposal, Hinge Block Connector, trackless trolley service in South Boston, Red Line to South Weymouth, 100 additional buses, transit to Union Square, and rapid transit to West Medford.
- Delete “heavy” in the description of Fairmount Line improvements.
- Group together projects that are mutually exclusive.
- System expansions should be described in such a way as to allow consideration of a variety of modes.
- Prepare graphics showing project locations and corridors.
- Post the System Expansion Project List on the Web site after the Working Committee has completed its review.

Meeting Notes
PMT Working Committee Meeting
February 19, 2002

In Attendance: Please see attached list.

Meeting Summary:

I. Call to Order

Dennis DiZoglio, Director of Planning, MBTA, called the meeting to order. Working Committee members, project team and guests introduced themselves. PMT Working Committee member Khalida Smalls has indicated that she is intending to step down from the committee.

II. Environmental Justice – David Mohler

David Mohler, manager of Environmental Justice issues for the MPO, provided an overview of the work of the MPO and its Environmental Justice Ad Hoc Committee, pursuant to federal Title VI and Department of Transportation orders. He explained that the MPO had been asked to review MPO policies and programs in the Regional Transportation Plan (Plan) to ensure that minority and low income communities are treated equitably regarding benefits and burdens of the transportation system. In this process, the MPO inventoried and located low income and minority communities; compared transportation benefits and burdens between these and other communities; and then developed measures (such as level of crowding, schedule adherence, mobility) to evaluate the current system. Most measures relate to transit, the Ad Hoc Committee's major area of interest. The mobility analysis looked at origin and destination points, including non-work trips. Evaluation data will be included in the Plan and will inform PMT analyses.

Results of the evaluations showed that schedule adherence is much the same for minority compared with non-minority buses and for low income and non-low income communities. Buses serving minority and low income communities may be slightly more crowded (but the differences are statistically insignificant). Travel speeds of trips to and from minority neighborhoods tend to be slightly slower while those to and from low income neighborhoods tend to be slightly faster. Some of these results, including the MPO's definition of Environmental Justice and its measures, have been submitted to and approved by the federal government. The Federal Highway Administration has notified the MPO that it has earned "Best Practice" status for its process and analysis. The Environmental Justice work is also trying to address issues of cross-modal comparisons. Other issues requiring additional attention by the MPO include evaluating benefits to low income and minority communities resulting from service to non-low income and non-

minority communities (air quality, traffic reduction), and providing service to low income and minority communities in the suburbs.

If the Plan identifies problems, the PMT can try to address them. In addition, the PMT will incorporate the Environmental Justice concept in its performance measures and will review project ideas considering Environmental Justice as one criteria.

Members' Suggestions and Comments:

- There are concerns that comparisons between bus and rail service should be made (some communities closer to Boston have longer travel times than more distant communities).
- There are concerns that the MPO did not discuss Environmental Justice issues when it identified a transportation network for public circulation in the draft Plan.
- Some perceive that actual travel times for low income and minority communities are greater than those reported.
- Transportation benefits may be a result of implementation of a particular network of projects included in the Plan, but may also be the result of actualization of a land use scenario.
- The Environmental Justice community should be part of the discussion during decision-making as a part of the PMT process.
- The MPO will further discuss the issue of flexing federal highway funds to transit projects, which may result in more funds available for transit.
- The process that prioritizes transit spending should demonstrate how Environmental Justice issues have been considered, particularly through the application of the PMT measures.
- Care should be taken in using the term "minority population", so as not to imply a larger minority population than exists. It might be useful to look at ridership survey data or take other steps so as to get a better understanding of a neighborhood's mobility.
- Low income and minority communities should be represented in this process.

III. Discussion of Pre-Screened System Expansion Project List

Clinton Bench, CTPS, reviewed the maps showing the ideas suggested for the PMT with the prescreened project listings highlighted. Other maps were also made to show the areas with existing MBTA and RTA fixed route service and show regional transit authority boundaries. Members referred to the revised Suggested Pre-Screened Project List handout as they continued their discussion of projects to be included in the pre-screened project list. If a project requires a significant capital expenditure, it is considered for the system expansion list; projects proposing more service that do not require a major capital expenditure are moved to the service planning category. Service frequency and routing issues generally belong in the service plan, not the PMT. Some items considered are old ideas that have been suggested for additional review. Accessibility projects are discussed as enhancement projects. There will be a discussion of possible funding sources within the final PMT document.

Members' Suggestions and Comments

- Include reducing the number of stops along the C and D routes of the Green Line in the list of pre-screened projects.
- Add an item for the "Y" connector, which would provide the option of not going to South Station.
- The Working Committee should consider including an item on "four-quad" gates.
- The MBTA should take a position advancing the elimination of grade crossings throughout the commuter rail system.
- Include consideration of a transit option for the South Weymouth Naval Air Station.
- Include a project advancing a signal preemption or an Opticom system.
- Keep the two service planning items, "New express bus routes" and "Intra-suburban bus service" in the system expansion list.
- Concerns were expressed that moving projects to the service planning category minimizes the attention they receive or would put them at risk for service cuts.
- A project that would provide for acquiring buses for inter- or intra-suburban bus service (thereby making the service affordable through leasing vehicles to private operators) could be justified as a service expansion project. One should be included.
- Provide analysis for capital costs for ten potential suburban bus routes.

IV. Working Committee Member Ideas and Items

None were raised.

V. Action Items:

- Provide information that explains the reasons each omitted project was excluded from the list of projects.
- Create a new entry for the combined Silver Line items (page two).
- Revise the commuter rail item "Build a regional commuter rail station on I-495 in the Littleton area" to refer to a regional station at Devens and include in the list.
- Include a narrative describing in general terms the MBTA's policy regarding grade crossings and "four-quad" gates.
- Remove the "Xed" item on the Union Square station noted on page eight.
- Include narrative that discusses an integrated (flexing and joint funding) approach to fund transit projects that rely on roadway improvements.
- Include the item "Build new busways to Alewife Station" as a system expansion item, not a service plan item.

Meeting Notes
PMT Working Committee Meeting
March 19, 2002

In Attendance: Please see attached list.

Meeting Summary:

I. Call to Order

Dennis DiZoglio, Director of Planning, MBTA, called the meeting to order. Working Committee members, project team and guests introduced themselves. The first draft of the explanations for project exclusions was distributed.

II. Draft of Prescreened System Expansion Project Listing – Clinton Bench, CTPS

D. DiZoglio emphasized that the list is still a draft and ideas and input from the committee are welcome. Clinton Bench said that the PMT and the Plan Update staff have shared ideas on projects raised during their respective outreach and development processes. All items mentioned for the Plan Update are included in the PMT Universe of Projects.

The water transportation items have been added to the list of Prescreened System Expansion Projects and members were asked to review them. Four items passed the prescreening: ferry expansion to Russia Wharf; high speed service from the North Shore to Boston and the airport; increase ferry service from South Shore communities into Boston and improve ferry infrastructure; and restore East Boston ferry. Operation of ferry service through the Cape Cod Canal was not included. More information on project descriptions, including costs, will be included in PMT text as it becomes more fully developed.

The Committee reviewed the first draft of the written explanations for the elimination of projects. This draft addressed only rapid transit projects. Work is underway on text for other modes and another draft will be distributed before the next meeting.

Members' Suggestions and Comments:

- Viable services from the Water Transportation Study should be incorporated in the PMT.
- Feeder buses might serve the commuter boats.
- Add "alternative fuel" as an element to the commuter boat projects.

- Remove the monorail idea from the pre-screened list. It is not compatible with the multi-agency visions for future use of the surface between North and South Stations.

III. Service Enhancement Project Performance Measures

D. DiZoglio explained that the intent of the discussion is to review evaluation criteria for the parking expansion and accessibility enhancement projects. Performance measures for the expansion projects (projects that extend service to new markets) have been developed; those for system preservation projects (projects that maintain a state of good repair) and other enhancement projects will be developed in the future.

Parking Expansion

Ron Morgan discussed the MBTA program for planning parking expansions. Parking is a major element of enhancement projects. While the MBTA has three primary criteria for evaluating parking expansion (location, cost effectiveness, and projected demand), there are many other factors (funding, timing, political issues, and reaction to change) that affect the viability of parking expansions. Criteria for identifying parking lots as good candidates for expansion include: convenient access, land and air rights, demand, capacity, cost per space, environmental issues, implementation, community support, andfunding options. The MBTA is now in the process of ranking the areas considered for expansion. The list of stations considered was distributed as well as the short-listed set of stations. Evaluations try to balance factors fairly. The MBTA is attempting to address the large public demand for additional parking at transit stations. Information on station usage is included in the MBTA parking study. The MBTA cannot control local land use decisions. Ultimately, the community decides if it wants to take steps to support transit-oriented development when such projects advance.

Accessibility

Steve Woelfel presented the five criteria that was previously used to establish the priorities for station accessibility improvements within the Key Station program. These are guided by ADA requirements. These will be the starting point for current planning related to accessibility improvements.

- Passenger boardings – consideration of passenger traffic volume.
- Transfer points – to see if transfers could be made easier.
- Connectivity – identify stations with multiple modes.
- Terminal stations – make them accessible.
- Activity Centers – employment, health care, government services, entertainment.

The development of a new Key Station Plan will dovetail with the PMT. Some input from communities, particularly on commuter rail stations, has been received. Some stations are more accessible than others; sometimes just by virtue of their location. New stations must provide access along the full length of the platform. Existing stations can be upgraded with mini-high platforms. There will be consideration of the varying degrees

of accessibility at existing stations in establilshing priorities within the PMT. The MBTA will provide an update on the Key Station Plan and will propose criteria for selecting accessibility projects at the next meeting.

Members' Suggestions and Comments

Parking Expansion

- Change the title of the general category from "Enhancement Criteria" to "Service Enhancement Criteria".
- Parking should not be considered as its own independent category. The issue should be providing access and this includes feeder bus, walking, and other modes, not just by additional parking. There should also be a consideration of whether transit-oriented development is encouraged.
- It would be useful if the criteria could be used to determine whether large regional parking lots or expanded local stations are a better approach.
- It might be useful for members to see information on station usage: existing ridership, parking demand, walk-ins, etc.
- It would be interesting to know if the unmet demand for additional parking could be satisfied by another option and whether parking charges affect the demand.
- It should be made clear that the criteria presented are not intended to be used for siting new stations, but for expanding existing stations.
- Add an item asking if the expanded parking would interfere with or support access by other modes.
- There should be a set of criteria for siting new stations and should include: impact on existing stations, access by non-auto modes, and existence of zoning that promotes multi-use development.
- The criteria should encourage walking or taking high occupancy vehicles to transit and should support development around commuter rail stations that optimize this.
- The MBTA should take a leadership role working with communities to develop overall plans for access to the stations.
- The MBTA should look at the cost of a demand-responsive bus service.

Accessibility

- Please provide information on legal commitments and mandates for improvements.
- Reorganize projects to provide a separate category for stations at which current construction is addressing accessibility issues.
- ADA makes a very clear distinction in defining accessibility. A station is either accessible or not.

IV. System Preservation Projects, Criteria and Weighting

D. DiZoglio discussed the three criteria considered for evaluating system preservation projects: indicators of condition (age), operational impact, cost effectiveness. In identifying Capital Investment Program improvements, the criteria are weighed, with age accounting for 60%, operational impact, 20%, and cost effectiveness, 20%, so that system

preservation projects can be given priorities. Views on these values for criteria were requested. The MBTA approach is a national model for system preservation evaluations.

Members' Suggestions and Comments

- Conduct several model runs giving the criteria varied weights and compare the results.
- Age is an important indicator of state of good repair, particularly if the analysis leads to vehicle procurement.
- Ventilation and lighting of vehicles is important and can affect ridership.
- Deferred maintenance costs should be factored in.
- Condition is a more important consideration than age, which may not be an accurate indicator.
- Budget should be a factor.
- PMT categories should easily relate to the Capital Investment Program categories.
- It will soon be time to review progress with the MBTA Advisory Board.

V. Working Committee Member Ideas and Items

None were raised.

VI. Action Items:

- Discuss the progress and any interim results of the Water Transportation Study.
- Add alternative fuel commuter boats to the System Enhancements category.
- Distribute the next version of explanations of the elimination of projects before the next meeting.
- Change the title of the general category from "Enhancement Criteria" to "Service Enhancement Criteria".
- Provide information on legally mandated accessibility improvements.
- In list of accessibility projects, create a column to note "being addressed".
- Provide an update on the Key Station Plan.
- Propose criteria for selecting accessibility projects at the next meeting.
- Conduct several model runs applying varied weights to system preservation criteria: 60/20/20 and 60/10/30.
- Consider the cost of deferred maintenance and budget.
- Meet with the MBTA Advisory Board after the May PMT Working Committee meeting to discuss prescreening and criteria.

Meeting Notes
PMT Working Committee Meeting
May 21, 2002

In Attendance: Please see attached list.

Meeting Summary:

I. Call to Order

Dennis DiZoglio, Director of Planning, MBTA, called the meeting to order. Working Committee members, project team and guests introduced themselves. He said that much of the agenda will summarize progress to date in the main categories of projects and that the MBTA is hoping to complete evaluations over the next several months. He asked members to make sure they had picked up copies of all handouts.

II. System Expansion

D. Dizoglio said that the projects in this category were being analyzed using the criteria discussed previously. Members reviewed copies of the full universe of system expansion projects with notations and explanations on their status in the shorter list of pre-screened projects. The evaluation can include an evaluation of carbon dioxide emissions. The quality of connectivity will be a consideration.

Members' Suggestions and Comments:

- It is important to include in the analysis a consideration of connecting neighborhoods (particularly low-income and minority) with jobs and other destinations, and to use the most current demographic information.
- Land use issues should be included in the criteria.
- The Urban Ring should work toward a level of service of one-minute headways.
- Activities that support optimal performance (capacity expansion) should be flagged.

III. System Preservation

The MBTA has prepared a database providing information on system status for its infrastructure. When preparing an analysis of which facilities to prioritize for maintenance, the MBTA uses a 60% weighting for the age factor, 20% for cost-effectiveness (number of people served/cost), and 20% for effects to operations. At the request of the Working Committee, the project applied revised ratios of 30% for cost effectiveness and 10% for operational impacts. Under this scenario, more commuter rail and bus station maintenance was called for, but no significant changes emerged. Joe

Cosgrove distributed information showing unconstrained needs.   He said that financial assumptions from the Regional Transportation Plan (RTP) (70% of MBTA budget spent on state of good repair projects) were being entered into the model. More heavily weighting the ridership factor would tend to reduce emphasis on maintenance of facilities. This database is an evaluation tool, not a programming tool. Allocation of funds to the Central Artery has deferred maintenance of other portions of the existing highway system, so that flexing highway funds to transit may not be feasible. The MPO will consider flexing and make decisions about it in the future.

Members' Suggestions and Comments

- Flexing funds from highway to transit would give the MBTA greater capacity to apply money where its needed.
- There may be a middle ground between totally unconstrained and constrained funding programs.
- The MBTA should base its revenue projections on a 7% increase in sales tax income, instead of the currently-used factor of 3%. This would expand the amount of funds available for projects.
- The PMT is a vision-document and should not be constrained by the RTP.
- Expand the amount of funding for these projects.
- Heavy weighting of the age factor may not account for incremental maintenance and repair of some system elements.
- The Working Committee needs to understand the most pressing system preservation needs.
- The issue is not necessarily the dollar value of a resource, but also its usefulness that should be considered in system preservation decisions.
- The Working Committee should assist in evaluating transit needs for the future.
- Transit has a suburban element, not just an urban one.

IV.   Service Enhancements

The MBTA has received many suggestions on service enhancements. We are looking at how to expand capacity through enhancements. The universe of suggestions has been pre-screened using the same criteria as that used for the expansion projects. Expansion criteria will also be used for further evaluation.

Enhancement projects might improve the experience of existing riders, attract new riders, or better utilize existing capacity. Examples are automatic fare collection and improved signals and communication for better on-time performance. Some ideas in the universe were pre-screened out because they did not increase ridership. For commuter rail, double-tracking is an example. Non-motorized mode projects belong in enhancements, not system expansions. The MBTA does not support the use of four-quadrant gates at commuter rail grade crossings. MBTA policy does not allow shared rights-of-way with

existing commuter rail and does not construct bike paths, but is working with the City of Somerville on a bike path project.

Members' Suggestions and Comments

- The Red/Blue connector should remain a consideration.
- Some proposals seem to conflict with or make others obsolete.
- Clarify the differences between the two commuter rail references, one on page 3 and the other on page 5.
- Regularity of service is a big factor in decisions to choose transit.
- Signs and notices at bus shelters should include route numbers and maps of routes.
- The PMT should address the issue of sharing rail rights-of-way with bike paths.
- The PMT should be a vision document going beyond a strict discussion of capital expenditures.
- In general, pedestrian access should be in place for non-motorized mode facilities.
- Members, as well as citizens, should be able to make suggestions.
- There seems to be a movement to avoid new trackless trolleys.

VI. Service Enhancements – Parking

Members' Suggestions and Comments

- Conduct several model runs giving the criteria varied weights and compare the results.

VII. Working Committee Member Ideas and Items

None were raised.

VIII. Action Items:

- For System Preservation, conduct three model runs: based on unconstrained funding, funding projected in the RTP, and expanded funding which considers increased sales tax revenues.

- Discuss the issue of shared right-of-way in the PMT text.
- Take out references to exclusive lanes and priority signals on page 6.
- Add more text discussing the bicycle parking stations.

Meeting Notes
PMT Working Committee Meeting
June 25, 2002

In Attendance: Please see attached list.

Meeting Summary:

I. Call to Order

Dennis DiZoglio, Director of Planning, MBTA, called the meeting to order. Working Committee members, project team and guests introduced themselves.

II. Prioritization of System Preservation Projects

Mr. DiZoglio introduced the MBTA's infrastructure asset management database. Clinton Bench handed out a listing of elements in the infrastructure and funds needed for maintaining their state of good repair. The list shows the level of expenditure required to bring the entire system to a state of good repair in 20 years. He explained that the MBTA decided to look at possible spending with both fiscally unconstrained and constrained parameters. Projects listed in the high priority group were consistent with the Regional Transportation Plan (Plan) and that could be undertaken with a funding level of $470 million/year (the level of expenditure to maintain the current state of repair) for the first five years. Unconstrained, the figure is $4.5 billion over seven years. Seventy-five percent of the capital budget will be targeted for state of good repair items. Medium priority projects were those that, within the fiscal constraints of the Plan, could be undertaken over a 20-year period. All other projects that are needed for a state of good repair were given low priority. The Plan is a 25-year document, while the MBTA asset management database is a 20-year program, so some adjustments might need to be made.

The asset management database is an evaluation tool, not a programming tool. These priority groupings are recommendations, not mandates, and they are not compared with system expansion projects. This listing, however, could be useful in advocating for state of good repair projects. Decision-makers can use them for identifying projects they want to target for earmarked funding.

The prioritization is based on a loose formula: 60% age, 20% operational impacts, and 20% ridership. (Testing other percentage splits yielded outcomes that unduly favored facilities with high ridership over system-wide support and maintenance facilities.) Members can consider these listings and make recommendations about adjustments they think should be made. The committee might take a look at how much state of good repair work should be front-loaded in the early, high priority years.

The text of the report will provide explanation for these figures. The PMT will make it clear that the highest priority will be system preservation and will explore ways to identify elements as projects in some areas.

Members' Suggestions and Comments:

- This listing and prioritization of projects should be seen as dynamic and changing.
- There should be some analysis, reviewed with the public, of requirements to bring the system to a state of good repair.
- The figures should be better explained.
- Auditors, project managers, and planners will view these numbers differently. That should be explained in the preface.
- Use project-based or funding methods to identify the work to be accomplished.

III. Justifications for Projects Excluded from Service Enhancement List

S. Woelfel presented information on items excluded from the Service Enhancement List. The material distributed gave reasons some projects were not included. In comparison, fewer System Preservation items were screened out because they have been part of planning for a long time. One item, the Back Bay/South Station Shuttle, would use existing tracks to provide service between the two locations for Old Colony riders and the Longwood Medical area workers, and Back Bay residents. For the Mishawam STAtion, connections to allow access to the other side of the right of way would cost millions of dollars. There might possibly be an at-grade solution. Concerning bus stops, planning their locations is a service delivery issue and might be best considered in service planning instead of in this section of the PMT.

Members' Suggestions and Comments

- Include double-tracking of the Old Colony Main Line in the PMT.
- The hotel owners abutting the old Mishawam Station believe the new station is not as convenient.
- Page 9, Bus/Trackless Trolley section, third bullet, "add exclusive lanes and priority signals…", and be more specific on which routes are good candidates for these improvements. The Boston Access project has a list of suggestions.
- A good relationship between the MBTA and the communities is very important.
- In signalization improvement projects, some projects are multi-jurisdictional and need good coordination between the entities. Grade separating Massachusetts Avenue and Melnea Cass Boulevard would be a very important, multi-jurisdictional improvement in Boston. This specific issue needs to be identified. There might be opportunities to bring in more resources.
- On page 9, add a new bullet with a general discussion of bus stop locations. This is an important issue. The City of Boston is looking forward to working with the MBTA on locating bus stops (on the far side of intersections). Also painting the pavement with special markings would prevent illegal parking (blocking buses) at bus stops. Modify text with, "Work with communities to identify better bus stop

locations, sometimes on the far side of intersections." There is a capital element involved in this item.
- Add "and schedule and vicinity map" to bus stop signing.
- Consider walls at bus stops, privately funded in exchange for advertising.
- Add a general discussion of a program or pilot project on improved access (including bike racks, bike lockers) at stations for bicycles.
- Standardize low-level door access on more cars on the Green Line.

IV. Outline for PMT Document

S. Woelfel discussed the draft PMT outline distributed to PMT members. The MBTA is looking for feedback from the Working Committee on the direction suggested by this outline. J. Cosgrove explained that the PMT has two functions: 1) the project screening for the capital planning process and 2) articulating the MBTA 's vision for public transit in the region. If the PMT focuses on the project list, the larger vision might be diminished. The document should spell out policy and priorities and inform the public of the choices, constraints, issues, and balancing among competing needs required to develop a capital program. Project evaluation is required, and might best be included in the Appendices, so that global content is more the focus. The PMT will use maps and other graphics. The PMT will discuss mobility challenges. Discussion and reference to MAPC land use information will be included. Section E summarizes the rationale for project screening and prioritization and references the detailed data in the Appendices. Local communities can use the PMT to inform local decisions. In local land use planning, the MBTA can make suggestions and cooperate, but communities have to lead the way.

Members' Suggestions and Comments

- Illustrating the data is important. The use of graphics will be key.
- In Section F, add information on the project implementation process.
- Add a discussion of multi-jurisdictional coordination issues and items.
- In Section C., include a discussion of land use.
- Look at land use as a comparable level of interest. Take regional planning issues by the horns
- Make specific references to how this relates to the regional land use plans and planning, and reference MAPC's work on this topic.
- Challenge the local control/home rule land use issues; stimulate creative thinking.
- The PMT should include a discussion on: congestion, options for controlling growth, planning for transportation mobility, and ways the investments in the infrastructure support planners' work to manage wisely.
- Make a statement explaining how the PMT vision supports the regional and local planning processes.
- Stimulate creative thinking; get people talking about policy, more than projects.

V. Working Committee Member Ideas and Items

The MBTA and the MBTA Advisory Board Capital Planning Committee will meet in July to continue discussions and coordination.

VI. Action Items:

- Include in the PMT a clearer explanation of the state of good repair project listings and their funding, and include this topic in discussions with the public.
- Revise language on page 9, Bus/Trackless Trolley section, third bullet, to read, "add exclusive lanes and priority signals…."
- Add the following text as a new bullet on page 9 at the end of the discussion, "Work with communities to identify better bus stop locations, sometimes on the far side of intersections."
- Add "and schedule and vicinity map" to the discussion on bus stop signing.
- Add a general discussion of a program or pilot project on improved access (including bike racks, bike lockers) at stations for bicycles.
- Reference MAPC work on land use planning and discuss the PMT's relationship to regional and local land use planning and possible use in growth management.
- In Section F., add information on the project implementation process.
- Add a discussion of multi-jurisdictional coordination issues and items.

Meeting Notes
PMT Working Committee Meeting
September 17, 2002

<u>In Attendance</u>: Please see attached list.

<u>Meeting Summary:</u>

I. Call to Order

Dennis DiZoglio, Assistant General Manager for Planning and Real Estate, MBTA, called the meeting to order. Working Committee members, project team and guests introduced themselves.

II. **Initial Model Results for System Expansion Projects** – Clinton Bench, Vijay Mahal

Updated lists of Service Enhancement projects and System Expansion projects were handed out. While there have not been many projects added to the list, there have been language changes and minor edits. A table showing the status of current prioritization (high, medium, low) for Parking Service Enhancements was handed out. Tables showing the status of Commuter Rail Service Enhancement and System Expansion projects' evaluations were discussed. The tables will eventually include rating information on all the performance measures. Model runs showing both utilization and air quality impacts for the system expansion projects have been done. Overall ratings shown are not final and are based only on these two performance measures. This is an example of how the MBTA is proposing to present information in the PMT. Commuter rail and rapid transit system expansion ideas will be divided into two groups, line extensions and new stations. The material will be organized so projects can be evaluated both overall and compared to others in the same mode and project type.

For air quality, performance measures examined were volatile organic compounds, nitrogen oxide, and carbon monoxide. The material shows the percent reduction in each for all projects listed. (The increase in pollutants from locomotives on commuter rail extensions has not been accounted for.) The results fell into natural groupings in high, medium, or low performance in each of these measures. Projects that rank high in reduction of pollutants tend to rank high in utilization, too. Air quality and ridership performance are often related. In view of these measures, new station ideas seem to rank lower than line extension ideas, but when cost per unit evaluations are done, the (low cost impact) new station ideas may be ranked higher.

CTPS personnel have been working with the Department of Environmental Protection (DEP) to identify a way to accurately estimate carbon dioxide impacts. Several approaches have been identified, but not yet implemented. Regarding particulate emissions, CTPS has draft calculations, but has no agreement yet with DEP on the process.

There are five different performance measures for utilization. Ridership, new riders, impact on mode share, and reduction in vehicle miles that have been projected. Reduction in crowding will be evaluated soon. The user benefit (travel time) measure has been taken out of the analysis because the state of the practice for measuring this has changed because the Federal Transit Administration has recently set new guidelines. CTPS does not have the software to measure this yet, despite its efforts to contact FTA. Commuter rail to New Bedford/Fall River, to North Chelmsford, and to Greenbush, along with the North/South Rail Link, ranked the highest. One new station idea, the MetroWest Regional Station at Route 495 is a medium priority and may become a high priority when all performance measures are factored.

Total priority rankings will be calculated from the number of high, medium, and low evaluations each project has earned. Natural breaks will define the three main groupings.

The model used for projecting ridership is more sophisticated than any other used in the past. The land use assumptions were the same as those in the Regional Transportation Plan. Projections are for the year 2025 and assume unconstrained capacity conditions. After the modeling results are in, staff fine-tunes them to account for specially-generated trips, such as to T.F. Green Airport in Rhode Island or to the Convention Center in Boston, that may not show up in the model.

The MBTA is working on parking expansions and other options for improving access to service. It is examining opportunities for shuttle services, looking at Quincy Adams pedestrian access, and working with MassHighway to identify possible pedestrian and bicycle improvements. Improved access is a PMT objective.

A decision about whether to weight performance measures in the final evaluations hasn't been made yet, but cost per new rider and reducing overcrowding seem to be very important factors. Increasing ridership on the system is a PMT goal. The MBTA will be looking for feedback on these issues.

Members' Suggestions and Comments:

- Add information identifying the specific site for each parking project listed
- Re-orient the "Service Enhancement – Parking Project Evaluations" to address broader "Access Improvements" issues. This would expand the evaluations to include actions that would improve patrons' ability to get to a station and use the service, not simply expand parking. Shuttle service, sidewalks, or land use issues are examples of actions that could improve access to service. An alternative approach would be to include text in the final PMT document discussing the issue.

- Local officials are generally interested in expanding parking, but neighborhoods aren't. If the planning approach involves developing and discussing a variety of possible options for improving access, the community may be more able to work as partners with the MBTA.
- There should be a discussion of greenhouse gases and transit project energy efficiency.
- Use the qualitative information, such as census tract data, to identify populations served and accessibility to jobs and to transit, in the evaluation of projects.
- Evaluate both traditional and new ridership patterns when making ridership projections.
- The MBTA should encourage FRA to modernize its requirements to focus on crash avoidance. Then, vehicles might be lighter and better.
- Cost per unit reduction is a more important performance measure than percentage reductions in emissions.
- The evaluation should rank projects within modes, then compare across modes or look at the entire system and evaluate the importance of each element in relation to its context in the region's broad geographical framework. This would allow an understanding of the benefits of interconnectivity.

III. **Proposed Public Review Process** – Steve Woelfel

Referring to the text distributed to members earlier, Steve Woelfel provided an overview of the possible schedule for next steps in the PMT process. Evaluations are scheduled to be complete by November, after which public reviews of the results may begin. There will be more editions of the newsletter and public workshops. Finally, the PMT will go to the MBTA Board of Directors for approval and then to the MBTA Advisory Board. Working Committee members will be notified of workshop dates. Completing and reviewing the evaluations may cause the schedule to slip a bit. Maps of ranked prescreened ideas and other visual materials will be used to facilitate discussions at workshop discussion stations. Workshops will be scheduled so as not to compete with the Capital Investment Program (CIP) public meetings.

Members' Suggestions and Comments

- The Advisory Board will be updated on PMT progress at its October meeting and through a mailing to all members. The Advisory Board will help provide public notice of the workshops.
- The public outreach should explain how the PMT and CIP relate.

IV. Working Committee Member Ideas and Items

The MBTA should consider using the rapid transit technology in operation in Toulouse, France for the Urban Ring, Phase III. It is automated, rubber-tired, and runs on one-minute headways.

V. Action Items:

- Develop a more comprehensive discussion of steps underway and planned to improve access to service, including bicycle and pedestrian access.
- Continue work projecting carbon monoxide impacts of new projects and provide text on greenhouse gases and energy efficiency.
- Provide information on public workshops to Advisory Board for circulation to its member communities.

Meeting Notes
PMT Working Committee Meeting
October 15, 2002

In Attendance: Please see attached list.

Meeting Summary:

I. Call to Order

Dennis DiZoglio, Assistant General Manager for Planning and Real Estate, MBTA, called the meeting to order. Working Committee members, project team, and guests introduced themselves.

II. Additional Results of Project Evaluations – Clinton Bench

- **System Expansions**

Clinton Bench explained that the evaluation process is still underway. He summarized progress on the system expansion commuter rail project evaluation ratings, reported in the sets of matrices handed out. For commuter rail, project ratings in the utilization category haven't changed. The mobility category ratings have been completed. Air quality has been advanced but is not yet complete and is waiting for information on project costs so that per unit-reduction costs can be calculated. Information on greenhouse gases will be added. Environmental justice ratings have been completed. The rapid transit evaluations have been completed to the same level as commuter rail. The overall ratings in both sets of matrices are preliminary, pending more information, analysis, and input from the committee. Project cost is an important element. All should be filled out for discussion at the next meeting.

C. Bench explained the components of the Environmental Justice and mobility measures. Some of them are qualitative which makes evaluation more difficult.

Processes and procedures for measuring Environmental Justice are evolving both locally and nationally. The Boston region is on the cutting edge of this work. Most projects being evaluated in the PMT won't result in burdens to a community without benefits.

Regarding mobility, the component "Service to Areas with Unmet Demand" means bringing service to an area in a way that improves access to transit and refers to bringing service to an area or time period where or in which it did not already exist. Trip time and frequency are criteria used to determine whether a new service is actually an improvement on any existing service. Projects that would provide additional reverse

commuting options can be given a medium or high ranking for “service to areas without unmet demand”.

Increasing the evaluation weighting of ridership and/or other performance measures may be considered after the initial evaluations have been done.

The Federal Transit Administration (FTA) is planning to calculate “user benefits” instead of “new riders” for its project evaluations. This will help areas with older transit properties to be more competitive compared with brand new transit systems.

Text in the PMT will provide definitions of the components used in each performance measure evaluation. The PMT will use the most current data available, but some of the 2000 census data will not be available in time for use in the PMT. There will be opportunities to revise the PMT every five years.

Members’ Suggestions and Comments:

- Ridership should be more heavily weighted in the evaluation. It should be its own category, not just one of seven considerations in the utilization category. Ridership also is integral to air quality improvements and might have funding implications, since it is highly valued by the FTA.
- Be sure to allow time for discussion of relative weightings among the categories.
- Apply the Executive Office of Environmental Affairs (EOEA) definition of low income (65% or less of average income) to see if it would change the PMT’s Environmental Justice evaluation outcomes. EOEA data could be more up to date.
- Revise the title of the Environmental Justice “Burdens on Target Neighborhoods” component to make it clear whether the evaluation indicates a reduction or increase in burdens.
- Make measures in Environmental Justice more quantitative and specific.
- Be more specific defining the components.
- Benefits to Burdens ratings should not be included for projects that do not serve or impact target communities. Where there are no effects to these communities, an “NA” should be used instead of the circle ranking.
- Change the title of the component from “Burdens on Target Neighborhoods” to “Reduced Burden through Increased Service”.
- Diverting a trip to Boston from the suburbs from highway to mass transit reduces the burden on the inner city and should be factored into the analysis.
- Members need the text of the report to fully understand and comment on the evaluations and proposed rankings.
- Moblility evaluations should consider land use and future development. Projects that have a high ranking based on land use potential for transit oriented development should be reviewed for consistency with existing local land use plans.
- Potential mobility and ridership benefits should be used in weighting projects.
- Federal agencies do not consider land use; ridership is the key factor.
- Remove Greenbush from projects under consideration. It is in construction.
- Provide written material on land use and ridership issues prior to the next meeting.

III. **Financing Options** – Dennis DiZoglio

D. DiZoglio reminded the members that though the PMT is a fiscally unconstrained document, it will discuss possible funding mechanisms. The PMT will include information on standard methods, new options provided by forward funding, and creative possibilities. (Please see meeting handout.)

The MBTA has a $1.065 billion operating budget. Revenue comes from the sales tax, the farebox, advertising, parking concessions, real estate, federal operating assistance and local assessments. One third must go to debt service.

Capital funding comes from MBTA revenue bonds and from federal funding sources (Section 5307 Urbanized formula funds, 5309 Rail Modernization, 5309 Bus Discretionary, 5309 "New Starts" grants). Another source is the Transportation Infrastructure Finance and Innovation Act (TIFIA) which provides federal credit to projects that have potential to stimulate investment from the private sector. Local funding options include tax increment financing, payment in lieu of taxes, joint development, betterment assessment districts, impact fee, and parking surcharge. State funding options include general obligation bonds, highway-flexed funding, and outside sections in the state budget. Private funding options include property transfers, station sponsorships, private employers financing transit, and MBTA promoted development.

Members' Suggestions and Comments

- Two additional funding sources are Grant Application Notes (GANS) (used at Maverick Station) and 121B funds (which could provide funds for station improvements/construction if it is part of a municipality's urban renewal plan).
- The FTA's BRT pilot program might be a source of funding.
- We should have more information on the implementation of impact fee procedures. Communities that are informed about transit have negotiated effectively to get transit funding from developers. DHCD provides training and this agency and the Executive Office of Economic Affairs might be able to provide information.
- The MBTA should coordinate with the Massachusetts Environmental Policy Act Unit (MEPA) to see if MEPA thresholds could relate to transit improvements.
- Include examples of possible applications for each of the funding options.
- Assembly Square should be considered for full public funding.

IV. Working Committee Member Ideas and Items

- Installing gates at grade crossings along commuter rail lines could be included in the PMT. This may improve safety and avoid whistle-blowing. This is promoted by the City of Gloucester.
- Information about the light rail service in Orleans, France was distributed. Additional information can be found at the city's Web site.

V. Action Items:

- Revise the mobility evaluations to better reflect the sense of the measurement components.
- Include discussions of performance measure weightings, land use, and ridership in the agenda of the November meeting. Provide information prior to next meeting.
- Change the title of the criterion from “Burdens on Target Neighborhoods” to something that more accurately reflects that we are trying to measure whether a project avoids placing burdens on a target community without providing substantial benefits. Where there are no effects to these communities, an “NA” should be used instead of the usual circle ranking.
- For the November meeting, prepare text that identifies the themes that have emerged from the evaluations.
- Remove Greenbush from the project list.
- Add to list of funding alternatives GANS funds and urban renewal (121B) funds through coordination with the state Department of Housing and Community Development.
- Provide additional information on implementation of impact fees.
- Provide additional detail on funding options for inclusion in the PMT, including examples of possible project applications.
- Post the Orleans, France Web site address on the PMT list server.

Meeting Notes
PMT Working Committee Meeting
November 19, 2002

<u>In Attendance</u>: Please see attached list.

<u>Meeting Summary:</u>

I. Call to Order

Joe Cosgrove, Director of Planning, MBTA, called the meeting to order. Working Committee members, project team, and guests introduced themselves.

II. Additional Results of Project Evaluations and Evaluation Issues

J. Cosgrove opened the discussion of the progress on project evaluations. MAPC has worked to provide additional information on land use for the evaluations and Ann McGahan is on hand to discuss evaluation of air quality issues.

Air Quality

A. McGahan said that she has contacted Sonia Hammel at the Executive Office of Environmental Affairs for direction on how to develop factors for greenhouse gas emissions. Transit vehicle fuel usage correlates to their greenhouse gas emissions. A. McGahan has contacted the major fleet owners in the region to identify fuel usage for buses (diesel and CNG projections) commuter rail locomotives, and commuter boats. Gallons of gasoline used by these fleets can be converted to grams of emissions per mile for new transportation services. This is a first step. Other pertinent information will be forthcoming. Methods are always being updated.

Initial system expansion evaluations with respect to air quality were discused for commuter rail and rapid transit proejcts. Air quality ratings were included. The project ratings on volatile organic compounds, nitrogen oxides, and carbon dioxide came out in the same order, so all three have been combined into one air quality performance measure. The commuter rail projects showed an increase of pollutants, so the measure title should be changed from "cost per unit reduction" to "cost per unit reduction in vehicle miles traveled." Carbon dioxide emissions are directly related to VMT. The increases in pollutants from diesel commuter rail service will be discussed in the PMT. Consideration of cold starts and fuel usage (miles per gallon) are included in the analysis.

Service Quality

There were six different sub-measures for service quality: personal safety, comfort and convenience of access, improved reliability, improved interconnectivity, customer information, and elimination of transfers/minimization of transfer time. Ratings for commuter rail service quality have been completed. Commuter rail and rapid transit projects don't always relate directly to these measures, and sometimes earned lower ratings as a result. Several projects did improve reliability, interconnectivity, and transfer time.

Communications projects will be included in the system preservation category. Some of these projects can also be funded from the operations budget. Safety will not be compared between modes or projects. There is little differentiation among them. The capital management database, using weighting factors as agreed upon by the Working Committee, will identify system preservation projects that might be funded given various levels of funding, within certain time frames. Projects that are fundable within the first five years (and are in the Regional Transportation Plan) will be high priority. Other projects will be ranked either medium (in the Plan) or low priority (if fundable in an unconstrained environment). Everything that defines a state of good repair will be included, but will be prioritized by funding availability. The database will be used as an evaluation tool. Prioritization can be adjusted, based on Working Committee and other public comments.

Land Use and Economic Impacts

B. Lucas presented the results of MAPC's information gathering on these topics. There are five different categories of land use impacts. For economic impacts, we identified the economically distressed areas that are targeted for development. Projects with at least 2/3 of station locations in the designated zones were given high ratings. Year 2000 zoning was also a factor. If 50% or more of the proposed stations were in a mixed use zoning area, the project would be given a high rating for "consistency with local plans"; if 50% or more were zoned for commercial or industrial use, a medium rating; if neither, a low rating. The MAPC regional plan, MetroPlan 2000, was used as a measure for "consistency with regional plans." The three service areas in the Plan (urban, multi-service with water and sewer infrastructure, and non-multi-service) provided ratings of high, medium, and low, respectively. Projects were rated high for Brownfield/Infill development if they used a site; medium if 50% or more of stations had 21E issues; and low for remaining projects. There is an amendment process that allows for modifying the PMT after it is adopted. Because local plans and priorities change frequently, the PMT should be able to reflect these in a timely fashion. Low priority projects may also be included in the Regional Transportation Plan. Comments that might improve the measures of land use and economy are welcome.

Costs

All costs are not yet available. Using MBTA information, experience, and studies, a set of unit costs to calculate project costs was developed. Mitigation costs have not been

included. The project cost estimates will be circulated as they are further developed. The model package calculating user benefits has just been received and will not be producing results for at least several months, possibly in 2003 for the new Regional Transportation Plan. User benefits as a measure has emerged as a way to fairly compare new rapid transit systems in the U.S. with existing transit systems for federal funding consideration. There are no plans to weight the performance measures in the PMT.

Members' Suggestions and Comments:

- Confirm whether the commuter rail fleets will use "clean" diesel fuel.
- Some buses are more fuel efficient than others.
- Emissions for a bus in traffic will be different than those on the expressway. It might make sense to separate out the express bus service.
- Diesel soot is also a major greenhouse gas component.
- Could the air quality model Mobile 6 be used in the evaluations, when it is available for use by CTPS?
- European rail equipment is much more efficient and reduces pollution by 50%.
- "Cold starts" result in more emissions, so VMT should be weighted to account for this in the early segment of auto trips to and from transit. Factoring in the number of trips (Mobile 5) would provide this analysis.
- The analysis should report just the emissions and not relate to costs. It should consider both the direct effects of transit use on air quality and the reductions resulting from auto usage changes. If cost is considered, capital and operating costs should both be factored in.
- Add a legend for each of the project rating charts.
- The analysis should consider fuel efficiency and should report the amount of fuel used.
- Report the figure for the change in the amount of pollutants from transit and the figure for automobiles.
- Add a broader definition of safety that would include a factor for automobile accidents.
- Should a funding-related document (the capital improvement data base) be used to rank projects for the PMT, an unconstrained document?
- Both local plans and local zoning should be considered.
- Maintaining internal consistency is important.
- The use of zoning data doesn't appear to be a good approach for project evaluations.
- Sometimes development proposals do not materialize, and local communities are sometimes reluctant to change zoning based on them.
- Building rail line extensions encourages development in suburban and rural areas and could result in additional highway construction, stations with surface parking and sprawl. These conditions should be picked up in the analysis.
- Local strategic planning along with commuter rail expansion can result in community revitalization, access to jobs, and other positive development outcomes. Commuter rail expansion could stimulate concentrated development around nodes, as well as strengthen access to the urban core.

- The PMT should include text that lays out the vision for the extensions and stations (size, aesthetics, zoning, related development), maybe through the description of an ideal situation.
- Include a narrative that describes the level of detail in the cost analysis.
- Combine capital costs and operating costs as a way to compare service enhancements and service expansions more equitably.
- Focusing on new transit riders gives an incomplete picture. Travel time savings should be considered, too, perhaps combining them into a single measure.
- The PMT should have a place holder for an improved user benefit analysis and discuss it in the narrative. Then, when completed, the new analysis can be inserted, before the document is finalized.
- Trip quality is important, too.
- Travel time should definitely be part of the analysis.
- How will the measures be weighted?
- Access to a commuter rail station in the Fort Devens development would be difficult.
- Add to possible funding sources: capital revenue bonds through non-profit corporations. These are being used to fund highway projects and may be used to fund transit.

III. Action Items:

- Confirm whether the commuter rail fleets will use the "clean" diesel fuel.
- Check on whether the current model considers cold starts.
- Report on projected emissions changes for projects.
- Add a legend for each of the charts.
- Include a narrative that describes the level of detail in the cost analysis.
- Add capital revenue bonds through non-profit corporations to the section on innovative funding sources.

Meeting Notes
PMT Working Committee Meeting
December 17, 2002

In Attendance: Please see attached list.

Meeting Summary:

I. Call to Order

Dennis DiZoglio, Deputy General Manager for Planning and Real Estate, MBTA, called the meeting to order. The MBTA made a power point presentation on the PMT so that members could provide comments and feedback. This presentation will be made at the public workshops scheduled for January 2003. The evaluations will be provided to the public for review and comment. After the public workshops, the MBTA will make revisions and submit a draft to the MBTA Board of Directors in March. After Board approval, it will be submitted in March or April to the MBTA Advisory Board for final approval.

The discussion in the public meetings will include project descriptions, an explanation of the evaluation criteria and measures and the process for developing the evaluations. Comments on the priority rankings will be incorporated into the first draft PMT document. Project ratings can be adjusted.

It was suggested that the MBTA might evaluate cost relative to total ridership, not just new riders. The evaluations were set up to address a lot of priorities. Other performance measures exist which can counter-balance any bias resulting from the cost effectiveness/new rider analysis. Environmental Justice evaluations are included in the PMT analysis. It is difficult to model travel time savings system-wide. There is no way to apply a consistent method to all projects when some cross into other MPOs. Comparisons with projects within the model may not be accurate. Central Artery commitments will be identified in the project descriptions.

The Chair will consider a possible ongoing role for the Working Committee.

Members Suggestions and Comments:

- Parking Enhancements shouldn't be a stand-alone category. The category should be more broad and include access by all modes. It could be called "Station Access" and include more than just parking for automobiles. The goal should be "improving access to the system". Text might include a list of possible projects and their

schedules for implementation. It could also include discussion of transit oriented development.

- Add to the "System Preservation" slide, detail on the percentage weighting. This dovetails with the state of good repair issue.
- Explain the importance of "pay as you go".
- Add the "pyramid" slide and the pie chart of the capital budget. It is important to show how the elements of the system work together.
- The Advisory Board has been supportive of investing in the existing infrastructure.
- The PMT should be an advocacy tool arguing for greater investment in enhancements and expansion projects. It should include information generating support for credible priorities. This document represents a future system. This is a vision document. The PMT can also be a tool for advocating for transit funding in general. It is also hoped that the state legislature will use it to screen earmarked projects.
- Striving for a balanced program is important. CLF wants to see the PMT support a program that serves the urban core and focus on transit dependent riders.
- Show whether a project, such as automatic fare collection, will improve the efficiency of the system.
- It is important to look at land use within the enhancement category of projects.
- There should be a different approach to the system expansion cost effectiveness analysis. It shouldn't relate only to new transit riders. This disadvantages existing elements. It shouldn't be a stand-alone category. Perhaps cost effectiveness should be a sub measure or linked to the goals of the PMT. At least explain it more. (Evaluate the cost relative to all riders.) If there is related private investment, this might improve cost effectiveness.
- Connect mobility to some measure of planned employment centers as well as existing centers.
- Consider a measure for whether a project would "serve transit dependent communities" and whether a project provides expanded access for transit dependent riders.
- Consider adding travel-time savings for existing riders to the analysis. Any information on this issue would be useful, even if not exactly comparable.
- How are Central Artery commitments factored in?

II. Results of Project Evaluations

Members reviewed the meeting handouts summarizing the preliminary results of the analysis. Clinton Bench, CTPS, answered questions.

If an expansion project does not have a component that helps the service quality, it will be given an "NA".

Member Comment:

- It seems as though many more boxes were filled in than left blank. Were there situations in which some circles were filled in when they might have been left blank?

III. Action Items:

- Revisit the cost effectiveness measure. Perhaps analyze cost relative to total ridership.
- Be more specific about considerations for providing additional service for transit dependent riders.

The next meeting will be January 21, 2003.

Meeting Notes
PMT Working Committee Meeting
January 21, 2003

In Attendance: Please see attached list.

Meeting Summary:

I. Call to Order

Joe Cosgrove, Director of Planning, MBTA, called the meeting to order.

II. Update on Recent Public Process

Pam Wolfe, CTPS, reported on the first of the January series of public workshops to review the preliminary results with members of the general public. The Boston workshop was very well attended, and though attendance at the Chelsea workshop was more sparse, both had lively discussions. The workshops were publicized in the December issue of the Monitor (sent through the PMT E-mail list, the MPOINFO E-mail list, to the Environmental Justice Committee, and by mail to interested parties outside the MPO region), in the January edition of TRANSREPORT (sent to more than 2000 recipients), in flyers (posted in rapid transit stations, passed out on buses and commuter rail, and faxed to municipal offices), and in press releases sent to daily and weekly newspapers in the region. In some instances, follow-up telephone calls to local and state officials provided reminders.

III. Schedule Update

Steve Woelfel reported that the draft PMT is scheduled to be available on February 12th. Its availability and notice of the 30-day public comment period will be advertised in the Boston Globe. There will be two public hearings: March 5th and 6th. The comment period will end March 14th. The PMT will then be reviewed by the MBTA Board of Directors before being sent in April to the MBTA Advisory Board for approval. There will be a Working Committee meeting in March, after the close of the public comment period. The PMT will be posted on the MPO Web site.

The PMT will be more streamlined than the last, but will still have sufficient details in the appendices on topics such as the evaluations and the public comments. While the narrative descriptions of projects, costs, and other information will be included in the circulation draft document, some lower level detail information, such as the interaction between projects on ridership, might not yet be available. The PMT will include for each project the following:

- a map and
- a narrative including a project assessment highlighting the overall rating,
- a narrative description of the project and its capital improvement highlights, and
- comparative information about costs and other performance measures.
- mitigation commitments.

Members' Suggestions and Comments:

- Members of the public need to see the complete analysis to do their review and assessments. All the analysis should be done and available.
- Legal commitments should be accompanied by narrative explaining status and information on the schedule for completion. This information lends support to these particular projects in the programming process.

IV. Performance Measure Review

Dennis DiZoglio explained that the MBTA had examined the issues raised by the Working Committee and has made adjustments to the performance measures. Clinton Bench said that the description of the individual performance measures for environmental justice were changed to give greater consideration to transit dependency. Improvements to connectivity between modes were reviewed to ensure they were adequately considered. Travel time savings will be incorporated in the analysis under Utilization as a way to consider more than just new ridership. Because the new software for calculating user benefits analysis is not yet ready for application in the PMT, the MBTA is using travel time savings as a way to provide similar information. This measure may give a boost to the ratings of projects that serve an existing, urban population and will not draw a large number of new riders.

Changes to some ratings were also made. Some capital costs were modified to reflect additional information and better cost estimates. Cost changes also resulted in new evaluations for air quality and new rider costs. Some projections of new riders and of air quality benefits also changed. Qualitative measures were also reviewed to ensure that performance measures were applied consistently; some revisions resulted. For environmental justice ratings, it is important to look at who is benefiting from the project. Changes to specific project evaluations were highlighted.

The MBTA will consider evaluating capital cost per reductions in emissions and moving consideration of vehicle miles traveled from Utilization to Air Quality. So far, the evaluations have tried not to weight performance measures.

Projects are not compared across modal categories. The scoring mechanism is different for each category. Performance measures are not weighted. Ratings will be done "on a curve" so that projects will be divided approximately into thirds for high, medium, and low ratings. The PMT is not intended to specify which projects will be built. Identifying too many projects as high priority would not improve its usefulness for decision-makers.

Members Suggestions and Comments:

- Include a list of environmental justice issues in the Regional Transportation Plan.
- Project definitions should include information on the capital elements involved. It is important to be consistent about which costs are included in projects and in the identification of any environmental justice communities served.
- The capital costs of reductions of emissions should be considered cost effectiveness measures.
- Reduction in vehicle miles traveled should be included in the air quality measure, not as a Utilization measure.
- Some found that it is not always possible to duplicate these preliminary results. The process should be transparent so that the analysis is consistent and can be replicated.
- It is important that this rating system not give a distorted view of how many important transit projects there are in the region. This system could give the impression there are fewer important projects than there actually are.
- There should be a discussion of why each project was scored as it was and of the qualitative information used in the decision, showing how the evaluation was made.

V. Access to Service

D. DiZoglio explained that based on Working Committee comments, the MBTA has broadened its definition of enhancement projects to consider all those that improve access to service, including those that address Americans with Disabilities Act issues; parking needs; pedestrian and bicycle access; and shuttle services.

VI. Members Items

George Bailey suggested using diesel multiple units (DMU) to increase frequency of service and provide additional off-peak service on commuter rail lines; one promising project might be Fall River/New Bedford. He suggested the MBTA explore this technology, widely used in France. Paul Regan said that this approach might resolve some of the mid-day storage and capacity issues at North and South Stations, as a DMU would not necessarily require its own berth. However, it should not be associated with only one project. DMUs might be used on the Fairmount Line and also might be used to provide reverse commute service. He said that this technology could give the MBTA flexibility and the ability to supplement other services. C. Bench noted that the ridership demand still calls for a relatively consistent train consist during peak hours. S. Woelfel said that the Fall River/New Bedford project has already decided against using DMUs and that this technology is currently not used in the United States. Ridership projections show a 45% increase in commuter rail ridership, which indicates that smaller vehicles will not provide enough capacity. Projects that increase capacity at North and South Stations or that provide added mid-day storage are pre-cursors to commuter rail expansion projects. This is a “super-priority”. Barbara Lucas said that there should be a cost estimate for this.

The next meeting will be scheduled in March after the close of the public comment period.

Meeting Notes
PMT Working Committee Meeting
March 25, 2003

In Attendance: Please see attached list.

Meeting Summary:

I. Call to Order

Dennis DiZoglio, Assistant General Manager for Planning and Real Estate, MBTA, called the meeting to order.

II. Report on Public Comments

D. DiZoglio discussed the comments received during the public review period. Written comments were received at the two public hearings, by mail, and by E-mail. A preliminary matrix, summarizing all comments and providing responses, was sent to committee members. One hundred twelve comments supported particular projects in the PMT; eleven opposed certain projects. For comments supporting projects, responses note that the commentor's project is in the PMT and will be considered for future funding.

Twenty-one comments said that a particular project should get a higher rating. Most of these were relative to several project ideas: Arborway Restoration, Assembly Square, extension of commuter rail to Millis, and extending the Green Line to Needham. The MBTA reviewed the referenced evaluations to see if there were errors or inconsistencies but after considering the additional data and the correspondent's anecdotal information, did not agree that those ratings should be changed.

Eleven comments recommended ideas for the Universe of Projects. There had been a lot of outreach to identify project ideas at the start of the PMT process. Many of the ideas mentioned had been considered and will be revisited for the next PMT.

Four comments stated that the legal commitments should be given high priority. The information in this section will be expanded. The MBTA will consider language submitted by member Toni Hicks, Conservation Law Foundation.

Seven comments focused on the evaluation methods, suggesting criteria be weighted or that the analysis be more transparent (easier to follow). Weighting was discussed frequently during the PMT process and participants suggested weighting a number of the criteria. Giving a preference for one measure over another would put the MBTA in a

position of valuing one individual's suggestion for a weighted measure over another's, a position the MBTA does not want to take. Overall ratings do not decide a project's status for future implementation. Each project has a narrative that talks about its evaluation. In addition, information in the appendices discusses the inputs and reasoning that led to the rating. The quantitative information is also included in an appendix. People do have an opportunity to see how the evaluations were made.

Comments suggesting changes in the actual ratings did not criticize the process; they provided views on why a change should be made. A discussion of how the regional travel model is applied will be included in the appendices. Because funding sources for most of the projects is uncertain, it is not possible to determine the debt-service cost. It was suggested that this measure be included in the operating costs.

III. Refinements to the Draft PMT

Members provided comments and specific suggestions for revising the PMT prior to its submission to the MBTA Board of Directors and, subsequently, to the MBTA Advisory Board. The MBTA agreed to make several suggested changes.

The following ideas were raised and will be addressed in the PMT Executive Summary, which will be prepared prior to consideration and action by the MBTA Advisory Board:

- Clarify the vision,
- Explain the PMT's role in regional planning and transportation decision making,
- Develop a matrix showing priority projects,
- Discuss system preservation and the improvements made in the transit system,
- Point out the Universe of Projects, and
- Emphasize the importance of continued progress.

Members Paul Regan and Scott Darling will be in touch with the MBTA as it develops this material.

Staff is preparing an Acknowledgement page for the Draft PMT for the Advisory Board.

The PMT suggests general categories for system preservation so that there will be flexibility to meet future needs. The CIP is the place for a more detailed listing of system preservation projects. Specifying a time frame for spending on certain systems might be useful. Policy-makers might look to the high priority projects across all modes if they are implementing this PMT's vision. However, there are many factors in decision making, and there are also more projects listed than can be undertaken. The PMT provides information, makes suggestions, and can be used in advocating for projects.

Members' Suggestions and Comments:

- Check to make sure comments from the Inner Core and the Central Artery Environmental Oversight Committee are included. Their comment on developing

systems maintenance and operations facilities should be considered in the Regional Transportation Plan (Plan).

- It was hard to understand the ridership forecasts because the assumptions do not seem to be documented.
- The total cost (capital and operating) should be identified.
- The evaluation uses precise numbers, but some are estimates. Round off the numbers.
- There should be information showing how well a project meets anticipated demand and relates to others. This might make the PMT more useful.
- Make several specific changes: a) add "current" before "manufacturers" on page 5-B/25 regarding DMUs; b) note in the narrative on the Urban Ring an objective of one-minute headways at peak hour and three-minutes during off-peak hours; c) include an acknowledgement page with the names of the Working Committee.
- More information on specific system preservation projects should be included. The MPO has been discussing spending the bulk of available funding on system preservation. This information should be considered in the Plan, perhaps even to the extent of including all the PMT high priority projects. The PMT should feed information and priorities into the Plan.
- The PMT defines an ideal and infers a directive; but it is a passive approach. It does not reinforce the gains made for transit during the Central Artery construction and the importance of system preservation. It should be more clear on how the vision might be implemented; particularly the system preservation elements. The vision articulated in the document is conservative, and could be better formulated so that the PMT has a more active influence on stimulating continued progress in improving the system.
- A clear vision in the PMT will be more useful than the list of high priority projects. This would help project proponents improve their project definitions. An empty circle in one performance measure doesn't mean that the project is bad.
- Evaluations of land use impacts should be based on existing conditions, not plans.
- The PMT is a dynamic process and document that will change over time. This should be explained in the Executive Summary, along with the vision, the importance of system preservation, and the discussion of the PMT's application in decision making.
- It is important that the review and approval of the PMT stay on schedule, with the Advisory Board taking action before the end of May. Members of the public want votes on documents like the PMT to take place before summer schedules begin in June.
- Put the Universe in its own appendix.

Summary of Public Workshops on PMT Preliminary Results

The MBTA conducted a series of workshops in January 2003 to review the preliminary results with members of the general public. Workshops included a Powerpoint presentation on the process for developing the PMT and an overview of the evaluations and analyses. A question and answer session followed. Workshops were held:

Wednesday, January 15, 2003 in the State Transportation Building,
Wednesday, January 15, 2003, in the Chelsea Senior Center,
Wednesday, January 22, 2003, in Framingham Town Hall, and
Thursday, January 23, 2003, in the Thayer Public Library, Braintree.

Overview of Comments

- There is a large backlog of demand for projects.
- There is a down-side to depending on the private sector for funds; project funding will reflect the private sector's needs, not necessarily those of the public.
- Chelsea supports the Urban Ring project as high priority.
- To accomplish smart growth in the suburbs, reduce parking and invest in feeder transit.
- If roadways adjacent to MBTA stations don't have sidewalks, the MBTA should invest in them.
- Clarify the categories of performance measures for system preservation projects. They seem subjective.
- The MBTA should partner with Zipcar.
- Look at the fare structure and eliminate the artificial barriers that fares create.
- Compare and prioritize projects between modes.
- Let Combo pass-holder riders use commuter rail at a discounted rate. You will get more riders and more Combo patrons.
- Communities that are just now getting service shouldn't be asked to pay.
- Building transit works against affordability for housing.
- Chelsea needs improved bus services.
- Bus service in Chelsea should be better coordinated with access to the Blue Line.
- Consider extending the late night hours of service. People who work at night need bus service. If there were more service, people would use transit more.
- Rail technology on the Urban Ring service would be more comfortable and reliable than bus technology.
- There is not enough information (schedule and pick-up locations) to take the Night Owl service.
- Keep commuter rail stations clean.
- More bus shelters are needed.
- Commuter rail expansion on the Marlborough rail spur would destroy an adjoining neighborhood and negatively impact Route 9 traffic. Existing freight traffic creates serious vibration impacts. There would be safety issues at grade crossings and potential fuel spills from derailed locomotives.

- Commuter rail service is run with different standards than rail freight. Providing service on the Marlborough spur would improve safety.
- There should be a balance between the needs of the urban core and those of the suburbs.
- MetroWest would like to work out developers' contributions to the LIFT service. Because of the direct relationship between development and traffic, developers must contribute to the LIFT.
- If the public is allowed to have input earlier in the planning process, it is more effective.
- The communities of Dover, Westwood, Needham, and Medway favor the commuter rail extension to Millis. Please make it a high priority.
- The Natick Bicycle Committee is very interested in getting people out of cars. Bicycles could travel long distances.
- Bicycle and parking proposals for solving our traffic and parking problems are not working.
- Move accessibility projects higher on the priority list.
- Lower parking prices at transit so more people will ride.
- Convert some parking spaces to bicycle parking spaces.
- Let the public use the Cochituate rail line right of way for bicycling. The MBTA says it will sign the access agreement with Framingham if the town will be responsible for hazardous waste clean up, but the town can't examine the right of way until it has access. The path also must have lighting.
- Consider raising fares as a potential funding source.
- There is not enough funding for the LIFT bus. There is no mid-day service. It makes it very difficult to travel. If one has a morning appointment, he/she have to wait all day to get home. Make paratransit a priority.
- Tax Increment Financing looks good on paper, but doesn't work here.
- Tax Increment Financing does work.
- Framingham is working to provide increased frequency for its suburban bus service.
- Framingham is concerned about the impact, particularly at grade crossings, of increased service on the Worcester line.
- Make the Newton/Needham light rail project a priority. This will lead to mixed use land uses and result in economic benefits. Newton Upper Falls has a dense population and could contribute 5,000-10,000 daily riders. The mobility evaluation should result in higher ratings, since there are about 200,000 cars per day on local arterial roadways from which to draw ridership. Cost effectiveness should be ranked higher as there are no land-takings required. Air quality will be improved by the cars taken off the road. This is an opportunity for an economic development park and for reverse commuting.
- Please schedule one more hearing in Fitchburg. *(The MBTA scheduled a meeting with the Fitchburg Line Improvement Working Committee, February 3, 2003.)*
- Natick needs bus service that is better coordinated with train service. We need service that links the train to the business district.
- The LIFT service is wonderful. I need it to get to my job.
- Bring back the Route 9 bus. There should be more feeder bus service to the train stations.

- Bus routes need to serve sites of medical services, not just employment.
- Bus lifts for wheelchairs often have problems.
- The park and ride lot at Shoppers World is under-utilized and not well-marked. There should be more funding to provide additional and better bus service.
- The Riverside Line should have automatic card readers. Passes shouldn't be limited to specific time-frames (monthly) and should allow access to all modes.
- If the MBTA provides facilities, commuters will use them.
- Maintenance should be programmed and automatic.
- Government agencies should place a limit on how much mitigation they are willing to provide, then move forward with the project. Citizens who simply want to block a project shouldn't be allowed to do so.
- Do not eliminate station personnel when the automatic fare collection is implemented.
- A number of people get free transportation on the commuter rail system.
- Some adjustments should be made to the performance measures.

Overview of Questions

- Will the next PMT reconsider projects that did not pass the screening process?
- How does the PMT relate to land use policy?
- Have you estimated the amount of funding to seek from the private sector in public/private partnerships?
- To what extent has the potential for car-sharing been considered in the analysis?
- Do some of the PMT projects overlap with on-going projects?
- How are the legally-mandated projects being funneled into the PMT?
- How was the utilization evaluation done?
- What is the progress on the Newton bus project?
- Is suburban transit in the PMT?
- Could buses be used to link North and South Stations?
- Is extending the Blue Line a high priority?
- What is the goal of Urban Ring Phase III?
- We have a development project that will create thousands of jobs. With whom do we work to improve transportation to our site?
- Can you make it easier for communities to secure transportation mitigation from developers?
- Will the MBTA maintain commuter rail stations?
- What is Tax Increment Financing?
- Has the MBTA begun to identify innovative funding options for specific projects?
- Is the MBTA working on the enabling legislation needed to move some projects forward?
- Why is Massachusetts providing commuter rail service to New Hampshire and Rhode Island?
- What is the impact (savings, reduction of jobs) of a smart card approach to fare collection? How will it help with accounting?
- Why is the E Line project called an expansion project in the PMT and an enhancement project in the CIP?

Written Comments Received During the Workshop Period

- Develop a grade crossing safety program for the Green Line along Commonwealth Avenue.
- Provide dollar bill changing machines on all surface lines.
- Avoid the cost of a tunnel at Union Square, Somerville, by branching the Green Line. One Branch could go to Union Square; the other to Gilman Square and beyond.
- Save the LIFT bus service and restore service on LIFT 5 from Framingham to Hopkinton and on LIFT 6 traveling to and from Holliston/Milford.
- Move "Reduction in VMT" from the Utilization measure to the Air Quality measure; and move "cost per unit reductions in emissions" from Air Quality to Cost Effectiveness.
- Reliability is the most critical service quality factor.
- Show how the evaluations were arrived at.
- Add an "operating cost per existing rider" factor to the Cost Effectiveness measure.
- Expand commuter rail parking at the Natick station.
- Streetcars can operate on busy city roadways and coexist with auto traffic.
- Give high priority to the restoration of the streetcar service on the Green Line through Jamaica Plain. It is important for air quality. Diesel and CNG vehicles are not good enough. (Several submissions)
- Place crosswalks and a "Yield to Pedestrians" sign at the corner of Washington and Northampton Streets along the Silver Line route. Safety is very important.
- Criteria are skewed against the Arborway Restoration project. It is a transportation control measure within the State Implementation Plan and should be given the highest priority. (Several submissions)
- Restoring the Green Line to Forest Hills/Arborway should be on the highest priority list. It will help the environment and thousands of commuters. (Several submissions)
- Move the E Line restoration to "SUPER HIGH #1" priority.
- A Fleet Center ticket should act as a commuter rail pass. Co-market transportation services.
- Evaluate all stations for bicycle/pedestrian accessibility
- Reduce the cost of off-peak train service and improve off-peak headways. This can be done by reducing the size of train sets and training some personnel to do several tasks.
- Consider a project that would provide rapid bus service along Mass. Ave through Arlington and Lexington.
- Improve bicycle/pedestrian access to stations.
- Work with Zipcar to place cars at transit stations.

Contact	Date	Summary	Response
Michael Gulbankian Gulbankian Bus Lines	2/10/03	Program for purchase of 20 45-foot parlor coaches every four years for the Commuter Bus program; will allow for replacements and growth.	The present MBTA commuter bus program requires carriers to provide the equipment.
Richard Magoon	2/10/03	Proposes a Southern New Hampshire MBTA Green Line Extension, using ultra-light hi-rail buses and light rail trains	The existing universe of projects was developed over an 18-month period. The deadline for adding a new project to the existing PMT has passed, however a new project to extend the Green Line to Southern New Hampshire can be considered in the 2008 PMT.
Mary Samuels	2/12/03	Asks for rush hour express train from Fitchburg to North Station.	The PMT examined the operation of express service from outer stations on all commuter rail lines including Fitchburg.
John Kyper	2/11/03	Make the Arborway light rail service a high priority and fully fund it so that construction can begin in 2004. (It is an environmental mandate.) Change the Silver Line Phase III bus tunnel to a light rail branch of the Green Line. The current proposal will not work well, nor will it meet the needs of the communities it serves. Address the deterioration of the Orange Line stations and subway.	The PMT includes a project to extend Green Line service to Arborway. All projects in the PMT were evaluated using consistent and objective criteria. A project's status as a legal commitment was used as an initial screening criterion for the PMT universe of projects. Consequently, all legal commitments were included in the PMT, and are thus eligible for programming in the Capital Improvement Program (CIP). The actual order of implementation for capital improvement projects is determined by the CIP - not the PMT. The PMT evaluates projects according to consistent and objective criteria, and this project did not rate as highly as others based on those measures. The Silver Line Phase III project has been in development for many years. The PMT includes the project proposal as defined through this process. The System Preservation chapter of the PMT includes preservation and replacement costs for all station facilities. Upgrades to station facilities would be eligible for programming in the Capital Improvement Program (CIP). The actual order of implementation for capital improvement projects is determined by the CIP - not the PMT.
Katherine Trapani State of Rhode Island and Providence Plantations	2/7/03	Include service to Wickford Junction, Rhode Island.	The T. F. Green project is included in the PMT. If the scope of this project is determined to include operation as far as Wickford Junction, then it will be included.
Mak Trifkovic	2/22/03	Route Blue Line to Medford extension via Charles/MGH; it will provide important connections. The Blue/Red connector should be a high priority. It is a commitment.	Changing the proposed Blue Line extension to Medford to operate via Charles can be considered in the universe of projects for the 2008 PMT. The PMT includes a project to construct a Blue Line-Red Line connector. All projects in the PMT were evaluated using consistent and objective criteria. A project's status as a legal commitment was used as an initial

Contact	Date	Summary	Response
			screening criterion for the PMT universe of projects. Consequently, all legal commitments were included in the PMT, and are thus eligible for programming in the Capital Improvement Program (CIP). The actual order of implementation for capital improvement projects is determined by the CIP - not the PMT. The PMT evaluates projects according to consistent and objective criteria, and this project did not rate as highly as others based on those measures.
Scott Delano	2/22/03	Expansion projects will attract new riders and improve the areas served. Recommends the Silver Line become rail. The North/South Rail Link and the Fairmont Line will help control sprawl and bring economic benefit.	The PMT includes a project to convert the Washington Street segment of the Silver Line to a Green Line branch. The PMT includes the North-South Rail Link project The PMT includes a project to improve the Fairmount Line.
Name Not Available	2/25/03	Weatherize the waiting areas at the bus stops along Washington St. The Silver Line is an inadequate replacement for the Orange Line	The design of shelters currently used at Silver Line stations was a product of both the MBTA and a community advisory committee to the Mayor of Boston. As a result, no substantial modifications are expected.
Anne Marie Leonard	2/26/03	Extend the Orange Line to Reading. Add Sunday and holiday bus service in Melrose. Eliminate grade crossings in these areas, particularly near the Wyoming Station on the Haverhill Line.	The PMT includes a project to extend Orange Line service to Reading. Proposals to changes local bus service are made through the MBTA's Service Plan process, not the PMT. The existing universe of projects was developed over an 18-month period. The deadline for adding a new project to the existing PMT has passed, however a new project to eliminate grade crossings can be considered in the 2008 PMT.
Garrett Bradley State Representative	2/28/03	Add two boats to existing Hingham, Hull, and Quincy service. Provide feeder bus to boat in Boston. Commuter boat service gets cars off of the road.	The PMT includes a project to expand commuter boat service to the South Shore.
Mike Dorsey	3/4/03	Supports the North/South Rail Link; reduce traffic and pollution and save travel time. Convert the Silver Line to light rail; save money and reduce health and community impacts.	The PMT includes the North-South Rail Link project. The PMT includes a project to convert the Washington Street segment of the Silver Line to a Green Line branch.
Glenn Dickson	3/4/03	Extend the Green Line to High Street, W. Medford or if not, to Tufts/Hillside in Medford. The right of way is there. The community needs the direct service.	The PMT includes a project to extend the Green line to West Medford.
Melissa Marantz Medical Academic and Scientific Community	3/5/03	Strongly supports the Urban Ring. Give the Urban Ring Project, Phases 1-3 high priority. State clearly that the project is 3 phased – not 3 projects. Put Phase 1 in the	The text of the PMT will be modified to make clear that the Urban Ring is three phased. The PMT is a financially unconstrained capital planning document.

Contact	Date	Summary	Response
Organization, Inc.		CIP. The current need is great; facilities are growing.	Therefore, it does not provide funding for project implementation.
John McDonald	3/5/03	Commit planning resources for the Green Line Extension to Medford Hillside.	The PMT includes a project to extend the Green line to West Medford. The PMT is a financially unconstrained capital planning document. Therefore, it does not provide funding for project implementation.
Menno Koning	3/5/03	Asks the MBTA to make the Millis Extension a top priority. It is feasible due to the increasing population and traffic congestion, will have more value than the Greenbush Line restoration, and can be implemented little by little; the track and signal upgrades are needed anyway; use Needham equipment. Links to the Green Line would improve service.	The PMT includes a project to extend commuter rail to Millis.
Carolyn Manson, Arborway Committee	3/5/03	Asks that the Arborway (E-Line) Project be given high priority. Supports the planning work to date on restoring light rail service, but would like it expedited. It will carry more people than buses; provide a no-transfer ride, clean, reliable service; reduce air pollution. Buses create soot and harm air quality. Also asks that the MBTA cease operating CNG buses and using the Arborway Yard to garage them. They may cause an explosion. Suggests moving the operation. Use electric vehicles.	The Arborway project was evaluated using standard criteria applied to all projects in the PMT. A project's status as a legal commitment was used as an initial screening criterion for the PMT universe of projects. Consequently, all legal commitments were included in the PMT, and are thus eligible for programming in the Capital Improvement Program (CIP). The actual order of implementation for capital improvement projects is determined by the CIP - not the PMT. The PMT evaluates projects according to consistent and objective criteria, and this project did not rate as highly as others based on those measures. The PMT is a financially unconstrained capital planning document. Therefore, it does not provide funding for project implementation. Your concern of CNG buses will be forwarded to MBTA Bus Operations.
Ralph Walter	3/5/03	Supports speaker at the March 5th public hearing suggesting electrification of the Attleboro Line. Electrification might be phased, beginning in segments close to Boston (Fairmont Line, Yawkee to South Station.)	The PMT includes a project to electrify commuter rail lines.
Bill Walker, Water Transportation Alternatives, Inc.	3/5/03	Construct additional vessels for existing and planned ferry routes and more parking; capital costs for ferry systems are competitive with other modes of transit. Ferry services are an integral part of Homeland Security.	The PMT includes a project to expand ferry service.
Leueen Lapitsky	3/6/03	Supports the North/South Rail Link; reduce traffic and pollution and save travel time.	The PMT includes the North-South Rail Link project.

Contact	Date	Summary	Response
		Convert the Silver Line to light rail; save money and reduce community impacts.	The PMT includes a project to convert the Washington Street segment of the Silver Line to a Green Line branch.
Mark Penner	3/6/03	Strengthen mass transit in the urban core; economic growth and reduce sprawl. Four commuter rail lines and the Orange Line traverse Somerville, but there are no stations. There is noise, pollution, community impacts. Suburbanites have better transit access to Boston.	The PMT includes a project to extend the Green Line to Somerville, one of the possible routing alternatives under consideration includes a stop in Union Square. The PMT includes a project to construct an Orange Line station at Assembly Square.
Mark Penner	3/6/03	Fast track design and construction of a commuter rail stop in Union Square.	The PMT includes a project to construct a commuter rail station on the Fitchburg Line at Union Square, Somerville.
Franklyn Salimbene, Arborway Committee	3/6/03	Prioritize the Arborway restoration project in the TIP. It is a Transportation Control Measure. It must be fully funded to maintain the region's SIP compliance. Arborway project capital costs should not include vehicle acquisition costs.	The PMT is a financially unconstrained capital planning document. Therefore, it does not provide funding for project implementation. A project's status as a legal commitment was used as an initial screening criterion for the PMT universe of projects. Consequently, all legal commitments were included in the PMT, and are thus eligible for programming in the Capital Improvement Program (CIP). The actual order of implementation for capital improvement projects is determined by the CIP - not the PMT. The PMT evaluates projects according to consistent and objective criteria, and this project did not rate as highly as others based on those measures. All Green Line expansion proposals evaluated in the PMT include the cost of rolling stock.
Gina Hahn	3/6/03	Strengthen mass transit in the urban core; economic growth and reduce sprawl. Four commuter rail lines and the Orange Line traverse Somerville, but there are no stations. There is noise, pollution, community impacts. Suburbanites have better transit access to Boston.	The PMT includes a project to construct a commuter rail station on the Fitchburg Line at Union Square, Somerville. The PMT includes a project to extend the Green Line to Somerville, one of the possible routing alternatives under consideration includes a stop in Union Square. The PMT includes a project to construct an Orange Line station at Assembly Square.
Katie Bacon	3/6/03	Somerville provides transportation infrastructure but gets no service; only noise and pollution. Suburbanites have better transit access to Boston.	The PMT includes a project to construct a commuter rail station on the Fitchburg Line at Union Square, Somerville. The PMT includes a project to extend the Green Line to Somerville, one of the possible routing alternatives under consideration includes a stop in Union Square. The PMT includes a project to construct an Orange Line station at Assembly Square.
Terry Fancher South Shore Chamber of Commerce	3/6/03	Supports the PMT. Make implementation of an intermodal pass system a priority.	Changing fare policy is not within the scope of the PMT.

Contact	Date	Summary	Response
		The Greenbush Line should be completed. Improve traffic flow at the Braintree Split on Route 3, widen Route 18, Weymouth, improve commuter boat service. The project development process should be streamlined. Citizens' groups have prevented many projects in the PMT from being constructed.	An assessment of the Greenbush commuter rail project has been added to the PMT.
Ann Hershfang	3/6/03	Emphasize providing safe and convenient access to transit stations. Post schedules at bus stops. Invest in GIS for buses; prevent bunching.	The service enhancements section of the PMT includes a project to improve pedestrian access to all rapid transit and commuter rail stations The section also includes a project to add 300 bus shelters and to install Intelligent Transportation systems (ITS) on the bus fleet.
Karen Wepsic	3/8/03	Include operational cost per transit rider. Give the environmental justice measure a greater weight because of past dis-investment. Check high priority projects' sprawl effects. Central Artery commitments should be high priority. Environmental justice benefits of Silver Line Phase 3 and Urban Ring Phase 2 are questionable. Urban Ring benefits suburban motorists.	The travel time savings analysis is intended to reflect the benefits a new project would bring to existing riders, and considers the impact on all riders. The MBTA and the PMT working committee, as part of an 18-month process to develop performance measures, determined it was best not to apply any weights to measurements. Changes to the performance measures used can be considered in the 2008 PMT Economic and Land Use impacts were considered for rail expansion projects. A project's status as a legal commitment was used as an initial screening criterion for the PMT universe of projects. Consequently, all legal commitments were included in the PMT, and are thus eligible for programming in the Capital Improvement Program (CIP). The actual order of implementation for capital improvement projects is determined by the CIP - not the PMT. The PMT evaluates projects according to consistent and objective criteria, and some projects did not rate as highly as others based on those measures. Appendix A has greater details of the environmental justice evaluations.
Daniel Radov	3/10/03	Prioritize bringing transit links to Union Square. Questions the number of new riders projected to use the Union Square, Somerville, commuter rail (seems low); how ranking determinations were made.	The PMT includes a project to construct a commuter rail station on the Fitchburg Line at Union Square, Somerville. The PMT includes a project to extend the Green Line to Somerville, one of the possible routing alternatives under consideration includes a stop in Union Square.

Contact	Date	Summary	Response
			Performance measures were applied equally to all projects considered in the PMT.
Kathryn Cotter	3/11/03	Encourages the extension of the Green Line to Union Square, Somerville; would bring multiple benefits to the community.	The PMT includes a project to extend the Green Line to Somerville, one of the possible routing alternatives under consideration includes a stop in Union Square.
Tom Connors	3/10/03	Extend the Green Line to Needham St.,Newton (instead of to Needham Hts./Junction) using existing tracks parallel to Needham St.; would provide access to work, shopping, and recreation destinations.	The project definition of the Green Line extension to Needham was developed during an 18-month open process, which included extensive public participation. Examining a Green Line branch operating only to Needham Street in Newton can be considered in the universe of projects for the 2008 PMT.
Helen Kim	3/12/03	Supports commuter rail or rapid transit to a Union Square, Somerville station.	The PMT includes a project to construct a commuter rail station on the Fitchburg Line at Union Square, Somerville. The PMT includes a project to extend the Green Line to Somerville, one of the possible routing alternatives under consideration includes a stop in Union Square.
Cindy Bishop	3/12/03	Bring rail-based public transportation to Union Square, Somerville.	The PMT includes a project to construct a commuter rail station on the Fitchburg Line at Union Square, Somerville. The PMT includes a project to extend the Green Line to Somerville.
Kathleen Ruane	3/12/03	Union Square needs a rapid transit or commuter rail station.	The PMT includes a project to construct a commuter rail station on the Fitchburg Line at Union Square, Somerville. The PMT includes a project to extend the Green Line to Somerville, one of the possible routing alternatives under consideration includes a stop in Union Square.
Cheri Ruane	3/12/03	Bring rail-based public transportation to Union Square, Somerville.	The PMT includes a project to construct a commuter rail station on the Fitchburg Line at Union Square, Somerville. The PMT includes a project to extend the Green Line to Somerville, one of the possible routing alternatives under consideration includes a stop in Union Square.
Aileen Bonilla	3/12/03	Supports the North/South Rail Link; reduce traffic and pollution and save travel time. Convert the Silver Line to light rail; save money and reduce community impacts.	The PMT includes the North-South rail link project The PMT includes a project to convert the Washington Street segment of the Silver Line to a Green Line branch.
Representative Carol A. Donovan	3/12/03	Reopen the Mishawum station. It formerly accommodated reverse commuting and would do so again. It would restore the ridership lost with the opening of the Anderson RTC, which is not easily accessible on foot. Make double tracking the commuter rail system, especially in Reading/Lawrence area, a high priority.	Mishawum station remains open for several reverse commute trains. The PMT includes a project to improve pedestrian access to Anderson RTC. The PMT includes a project to install double track in existing single-track segments of the commuter rail network.

Contact	Date	Summary	Response
James Rooney, Massachusetts Convention Center Authority	3/12/03	Construct the Commonwealth Flats Grade-Separation Project (T under D Street project). It is essential for Silver Line full potential; reliable service; aggressive headways. The MBTA should review and coordinate findings of related alternative analyses. Reanalyze possible Silver Line South Boston connections to the Red Line. Supports the PMT's ranking of the Silver Line South Boston Piers Project.	The PMT includes a project to construct an extension of the Silver Line right of way under D street. The PMT is a financially unconstrained capital planning document. Therefore, it does not provide funding for project implementation. The final routings of the surface portion of Silver Line beyond World Trade Center can be addressed as part of the MBTA's Service Plan process.
Robert Feigin	3/12/03	Strong support for the Medford Hillside Green Line extension. It is an important project with a commitment target date. Begin planning now. The community would welcome an extension of the Blue Line, too.	The PMT includes a project to extend the Green Line to Somerville, one of the possible routing alternatives under consideration includes a stop in Union Square. A project's status as a legal commitment was used as an initial screening criterion for the PMT universe of projects. Consequently, all legal commitments were included in the PMT, and are thus eligible for programming in the Capital Improvement Program (CIP). The actual order of implementation for capital improvement projects is determined by the CIP - not the PMT. The PMT evaluates projects according to consistent and objective criteria, and this project did not rate as highly as others based on those measures. The PMT includes a project to extend the Blue Line to Medford Hillside.
Kimberly Driscoll, Ward Five Councilor, City of Salem	3/13/03	Residents are concerned about a possible commuter rail and/or Blue Line stop in South Salem. The MBTA has not explored the possible impacts of these stations; should conduct a feasibility study. The City Council does not support extending the Blue Line to South Salem. Questions its inclusion in the PMT when most citizens have asked for increased commuter rail service and a connection to the Blue Line in Lynn or Revere. Improve the existing station before building another.	The PMT includes projects presently under consideration by the North Shore MIS/EIS process. The PMT examined the operation of express service from outer stations on all commuter rail lines including the Newburyport and Rockport lines.
Sally Shabaka	3/13/03	Construct ramps at stations for people who have luggage, grocery carts, and to ease pedestrian access. Silver Line buses are quieter and less polluting	The PMT includes a project to improve pedestrian access to all rapid transit and commuter rail stations.
Joshua Mello	3/13/03	The existing system should get more emphasis. Pre-emptive signals for the Green Line should have higher priority than improvements for the Red Line;	The MBTA has set a policy that at least 70% of its annual capital expenditures will go toward preserving the existing system. All projects in the PMT were evaluated using consistent and objective criteria. The Red Line signal improvements would accommodate projected

Contact	Date	Summary	Response
			increases in demand by 2025.
		The item Install 300 Shelters should include reconstruction of bus stop locations;	The final design of shelters to be installed can be considered if this project is implemented.
		Converting the Silver Line Phase II and III to light rail connecting to the Green Line would be better than the Yawkey/South Station shuttle.	The existing universe of projects was developed over an 18-month period. The deadline for adding a new project to the existing PMT has passed, however a new project to construct a Green Line branch from Arlington St. to South Station in place of the Silver Line can be considered in the 2008 PMT.
		Urban Ring phase II and Phase III should be built as light rail the entire length.	The development of the Urban Ring project has been the subject of an extensive public process prior to the PMT. The PMT includes those proposals generated from that process.
		Improved bus service from New Bedford/Fall River to Boston , Route 128 and Quincy Adams should be considered.	The existing universe of projects was developed over an 18-month period. The deadline for adding a new project to the existing PMT has passed, however a new project to improve New Bedford/Fall River bus service can be added to the universe of projects for the 2008 PMT.
		A commuter rail station in Union Square should include a multi-modal transfer facility.	The final design of a possible station at Union Square can be considered if this project is implemented.
		Fairmount Line should be converted to a full rapid transit line using DMUs	The PMT includes a project to upgrade the Fairmount Line. Final definitions of system parameters will be considered in greater detail as this project is advanced.
		A possible extension of Fairmount Line service to a new Riverside Station combined with pieces of the OPERATE HIGH-FREQUENCY READVILLE-ALLSTON LANDING and OPERATE HIGH-FREQUENCY RIVERSIDE-JFK/UMASS COMMUTER RAIL SERVICE projects should be studied. The trains, preferably DMUs would run at 10-15 minute headways from Route 128 Station to Readville, along the Fairmount Line to Broadway Station (transfer to Red Line), along the Worcester Line, stopping at Back Bay, improved Yawkey, Allston, Brighton, Faneuil, Newton Corner, Newtonville, West Newton, Auburndale, and new Riverside in Weston (connect to Green Line). Worcester Line trains could be	The existing universe of projects was developed over an 18-month period. The deadline for adding a new project to the existing PMT has passed, however a new project to operate a commuter rail line from Riverside to Route 128 via Back Bay can be included in the universe of projects for the 2008 PMT.

Contact	Date	Summary	Response
		rerouted along a short connector in Weston and Waltham to the Fitchburg tracks to allow frequent headways on the Riverside-Route 128 service Orange Line extension beyond Forest Hills should only operate to Roslindale Square.	The existing universe of projects was developed over an 18-month period. The deadline for adding a new project to the existing PMT has passed, however a new project to extend the Orange Line only as far as Roslindale Square can be included in the universe of projects for the 2008 PMT.
Edward Ganshirt	3/13/03	The PMT is too “Boston centric”. The MBTA should address suburb to suburb commuting, not just commuting to Boston. Create a secure funding mechanism for the successful suburban transit providers. Too much attention is paid to system preservation. Expedite the Route 128 circumferential bus and the Urban Ring. Abandon the Hyannis, Fall River, and Millis projects (promote sprawl).	The PMT is a financially unconstrained capital planning document. Therefore, it does not provide funding for project implementation. The PMT includes a project to develop suburban commuter rail feeder bus services. The PMT includes a project to develop a Route 128 circumferential bus service.
Jeff Perkins	3/13/03	Construct a rapid transit or commuter rail stop at Union Square, Somerville	The PMT includes a project to construct a commuter rail station on the Fitchburg Line at Union Square, Somerville. The PMT includes a project to extend the Green Line to Somerville, one of the possible routing alternatives under consideration includes a stop in Union Square.
Terry Jamro	3/13/03	Construct: 128/I-95, Needham to Canton; Green Line to Medford Hillside; North/South Rail Link; electrification of all commuter rail lines and improve track from Worcester and Providence; make the Urban Ring either light or heavy rail, not BRT; extend the Blue Line to Lynn; keep all equipment in a state of good repair; extend Night Owl hours (as long as vehicles do not need to be maintained at this time.) Provide discounts for users of alternative fuels. Increase the state gas tax to pay for transit projects.	The PMT is a transit planning document and does not include highway projects. The PMT includes a project to extend the Green Line to Somerville. The PMT includes a project to electrify commuter rail lines, construct phase III of the Urban Ring, and extend the Blue Line to Lynn. The existing universe of projects was developed over an 18-month period. The deadline for adding a new project to the existing PMT has passed, however a new project to eliminate curves on the Providence and Worcester commuter rail lines can be added to the universe of projects for the 2008 PMT. The PMT includes a state of good repair analysis. Any consideration of changes to Night Owl service would be the responsibility of the MBTA's service planing process, not the PMT. It is outside the purview of the PMT to consider changes in tax structure.

Contact	Date	Summary	Response
Form Letter on the Somerville Commuter Rail Line Station in Union Square – Sent by 40 Individuals	3/13/03	Make building a new commuter rail station on the Fitchburg commuter rail line in Union Square the highest priority. There are many benefits: direct service, lowest capital costs per new rider, small operating cost, provide access to service that has excess capacity, would serve a minority neighborhood. It also would help mitigate closure of the Lechmere station during Green Line viaduct construction; improve air quality; stimulate investment.	The PMT includes a project to construct a commuter rail station in Union Square, Somerville.
Srdjan S. Nedeljkovic, M.D.	03/13/03	Regarding the proposal to construct a Green Line branch to Needham: 1)The line should extend only to Needham Heights 2)The ridership numbers stated in the PMT are too low and may have omitted some aspects of the current base demographic and economic situation 3)There is ongoing and planned development which needs to be considered.	The project definition of the Green Line extension to Needham was developed during an 18-month open process, which included extensive public participation. Examining a Green Line branch operating only to Needham Street in Newton can be considered in the universe of projects for the 2008 PMT. CTPS travel demand forecasts utilize population and employment growth projections generated for the MPO by the Metropolitan Area Planning Council (MAPC). .
Mark Penner	3/14/03	Supports the North/South Rail Link; reduce traffic and pollution and save travel time. Convert the Silver Line to light rail; save money and reduce community impacts.	The PMT includes a project to construct the North-South rail link. The PMT includes a project to convert the Washington Street segment of the Silver Line to a Green line branch.
Miranda Elmorsi	3/14/03	Extend the Green Line to Union Square, Somerville. Access to Red Line is 25-minute walk; buses are unreliable.	The PMT includes a project to extend the Green Line to Somerville, one of the possible routing alternatives under consideration includes a stop in Union Square.
Dorit Ron	3/14/03	Supports the Green Line extension to Union Square and a commuter rail station there.	The PMT includes a project to extend the Green Line to Somerville, one of the possible routing alternatives under consideration includes a stop in Union Square. The PMT includes a project to construct a commuter rail station in Union Square, Somerville.
Shawn Hockert	3/14/03	Give the Green Line extension to Union Square, West Medford, a high priority. Access to Red Line is a 20-minute walk.	The PMT includes a project to extend the Green Line to Somerville, one of the possible routing alternatives under consideration includes a stop in Union Square.
Salem City Council	3/14/03	Asks the MBTA to provide more frequent service to Salem and use modern passenger cars; and construct a link between the current commuter rail line and the Blue Line in Lynn or Revere; but not to extend the Blue Line to Salem.	The PMT includes a project to construct a commuter rail station at Wonderland which would allow for transfers to the Blue Line. The PMT includes projects presently under consideration by the North Shore MIS/EIS process. The PMT examined the operation of express service from outer stations on all commuter rail lines including the Newburyport and Rockport lines.
Bill Reidy	3/14/03	Regarding the extension of commuter rail from Wareham to Hyannis, the capital cost is highly inflated; the track upgrades made in the 1980's should suffice for commuter	The capital costs for this project include rolling stock acquisition in addition to track, signal, and station improvements.

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		service.	
Margaret Sanfilippo	3/14/03	Strongly supports Green Line extension to Union Square; would greatly improve weekend mobility; help economic development	The PMT includes a project to extend the Green Line to Somerville, one of the possible routing alternatives under consideration includes a stop in Union Square.
Menno Koening	3/14/03	Develop a Kneeland Street to Causeway Street bus loop; would provide key link between North and South stations and points in between; would be important for tourist access. Asks the MBTA to make the Millis Extension a top priority. It will have more value than the Greenbush Line restoration and can be implemented little by little; the track and signal upgrades are needed anyway; use Needham equipment..	Changes to MBTA bus routes which do not require a capital investment would be considered by the MBTA's Service Plan process, not the PMT. The PMT includes a project to extend commuter rail to Millis.
Kellie Connelly	3/15/03	Plan a rapid transit or commuter rail stop in Union Square.	The PMT includes a project to construct a commuter rail station in Union Square, Somerville. The PMT includes a project to extend the Green Line to Somerville, one of the possible routing alternatives under consideration includes a stop in Union Square.
Steven Paris	3/15/03	Enclose staircases from street level to train platforms on the Framingham Line at the Newton commuter rail stations and on the Rockport Line at the Salem station. Re-open some currently closed station entrances: Boylston St. entrance to Hynes Convention Center, and Berkeley Street entrance to Arlington station. Construct a new station near Charles River Park, if the Blue Line is extended. Convert the Silver Line to light rail; use the existing abandoned tunnel.	The PMT includes a project to install more enclosed waiting areas along all lines. The closed entrances are opened during special events as required. It would be part of the MBTA's Service Plan process to determine if the facilities should be opened full time. If the project the Blue Line to west Medford is further developed, more detailed examination of exact intermediate station locations will be developed. The PMT includes a project to convert the Washington Street segment of the Silver Line to a Green Line branch.
Karen Wepsic	3/18/03	The analysis should be more rigorous and reviewed by neutral professionals.	The MBTA and the PMT working committee developed performance measures over an 18-month open process. The existing universe of projects was developed over an 18-month period.

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		Projects should consider operational costs per passenger, not per new passenger.	The travel time savings analysis is intended to reflect the benefits a new project would bring to existing riders, and considers the impact on all riders.
		Analyze projects across modes.	Each transit mode provides unique mobility options and is defined by unique operating characteristics that are not applicable to all communities in the MBTA service area. For these reasons, and because of the fiscally unconstrained nature and broad regional focus of the PMT, the MBTA has decided to create lists of high priority projects for each individual mode instead of a single high priority project listing for the entire system. The PMT Executive Summary does, however, provide information on the MBTA's highest immediate systemwide priorities, for which capital funding is already being pursued. Subsequent determinations of specific project-level funding priorities will continue to occur in the MBTA's Capital Improvement Program, as specified in the MBTA's enabling legislation. The MBTA and the PMT working committee developed performance measures over an 18-month open process.
		Give more weight to projects with environmental justice benefits.	The MBTA and the PMT working committee, as part of an 18-month process to develop performance measures, determined it was best not to apply any weights to measurements. Changes to the performance measures used can be considered in the 2008 PMT
		Questions whether high priority projects as a group fairly allocate benefits and whether they will encourage sprawl.	Land use impacts were considered as part of the PMT analysis of each project.
		Increased parking encourages auto use and sprawl.	Parking has been raised as an issue of concern during the PMT process.
		Questions the environmental justice element of: the Yawkey-Back Bay shuttle; the Fourth track on the Fort Point Channel Bridge; Double tracking the commuter rail system; and the Urban Ring Phase II. Environmental justice ratings for the various Green Line improvements seems arbitrary.	Environmental Justice analysis is described in greater detail in Appendix A.
		Use signal preemption to prevent bunching; the exclusive	Signal priority improvements are considered separately as part of the implementation of Intelligent Transportation Systems (ITS).

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		lane and priority signal project should be divided into two.	
		100 new buses should serve environmental justice routes to warrant this rating.	The 100 new buses would be added to the busiest bus routes in the present network. Many of these routes service environmental justice communities.
		Implement a bus to subway transfer policy.	It is not in the purview of the PMT to include fare policy analysis.
		Choose accessibility upgrades by boardings and proximity to handicapped housing/jobs.	Accessibility ratings considered proximity to major activity centers, such as employment or government centers, institutions of higher education, hospitals, or other facilities that are major trip generators for persons with disabilities.
		Expresses concerns that the Urban Ring Phase II rights of way will become general use roadways.	The proposed BRT elements of the Urban Ring are being considered as exclusive busways.
		Questions the high priority ranking for the East Boston ferry project.	After additional analysis, the East Boston ferry project is now designated as a medium priority project.
		Ridership projections for Restoration of Arborway service are low and should be revised; the Longwood Medical Area is a major job center; there is also an environmental justice component.	All projects in the PMT were evaluated using consistent and objective criteria. All PMT ridership analysis utilize population and employment growth projections generated for the MPO by the Metropolitan Area Planning Council (MAPC). .
		Spell out a project's impacts on the system.	Each project includes estimates of total new riders to the system the project would generate.
		Include modeling data and ridership projections.	Additional information for each project can be found in the Appendix section.
Christopher Irwin	3/18/03	Evaluating projects within modes creates unintended bias. The modes do not equally advance the PMT vision; some projects contributing less may be advanced before others contributing more.	Each transit mode provides unique mobility options and is defined by unique operating characteristics that are not applicable to all communities in the MBTA service area. For these reasons, and because of the fiscally unconstrained nature and broad regional focus of the PMT, the MBTA has decided to create lists of high priority projects for each individual mode instead of a single high priority project listing for the entire system. The PMT Executive Summary does, however, provide information on the MBTA's highest immediate systemwide priorities, for which capital funding is already being pursued. Subsequent determinations of specific project-level funding priorities will continue to occur in the MBTA's Capital Improvement Program, as specified in the MBTA's enabling legislation.

Contact	Date	Summary	Response
			The MBTA and the PMT working committee developed performance measures over an 18-month open process.
		Projects should direct growth to the urban core. Be more responsive to urban core mobility needs than to suburban demand for transit.	All projects in the PMT were evaluated using consistent and objective criteria.
		Current estimates of travel time savings do not adequately represent those of the future, considering future development and transit services.	All PMT ridership analysis utilize population and employment growth projections generated for the MPO by the Metropolitan Area Planning Council (MAPC). .
		Supports extension of the Silver Line to City Point for cost effectiveness, connections, and air quality improvements and asks that these factors be taken into consideration.	The PMT includes a project to extend the Silver Line to City Point. All projects in the PMT were evaluated using consistent and objective criteria.
Jodi Sugerman-Brozan, Program Director, Alternatives for Community & Environment	3/18/03	Give more weight to environmental justice and land-use criteria in choosing priorities; weight seems to be given to cost-effectiveness.	The MBTA and the PMT working committee, as part of an 18 month process to develop performance measures, determined it was best not to apply any weights to measurements. Changes to the performance measures used can be considered in the 2008 PMT
		Cost-effectiveness criteria should assess the capital costs and operating costs per rider, not per new rider; excessive operating costs are a financial burden; this also disadvantages areas with high transit use, as an investment yields fewer new riders and the project seems very expensive; the Dudley light rail conversion would cost $10,880 (capital) and $0.17 (operating) per rider, while New Bedford commuter rail would cost $94,499 (capital) and $9.75 (operating) per rider.	The MBTA and the PMT working committee developed performance measures over an 18-month open process. Changes to the performance measures used can be considered in the 2008 PMT. The travel time savings analysis is intended to reflect the benefits a new project would bring to existing riders, and considers the impact on all riders.
		Criteria for assessing utilization should take into account the total riders, not just the increase; transit dependent riders must use the existing system, so enhancements cannot yield large numbers of new riders. Criteria also do not consider needs for weekend and off-peak riders.	The MBTA and the PMT working committee developed performance measures over an 18-month open process. Changes to the performance measures used can be considered in the 2008 PMT. The travel time savings analysis is intended to reflect the benefits a new project would bring to existing riders, and considers the impact on all riders.

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		Mobility evaluations should also consider decrease in travel time per mile; in urban areas a commute of shorter distances can take more time than a similar distance on other modes. Projects that fill gaps in the network in urban core communities should also be given high ratings.	The Travel Time Savings analysis considers the total travel time savings generated by each project. The Mobility evaluation of each project considered the filling of gaps in the network. Greater details of these evaluations can be found in Appendix A.
		Projects that have high priority for environmental justice in the PMT do not represent the priorities of affected communities. Community groups oppose Silver Line Phase III (South Station-Boylston Connector); they have advocated for light rail on Washington Street (given a low PMT priority rating) connecting into downtown via the existing Tremont St. tunnel; a new tunnel is unnecessary. Benefits of the Urban Ring project to environmental justice communities has not been determined and are overstated.	Environmental Justice analysis is described in greater detail in Appendix A.
		The PMT should evaluate projects across modes, giving equal weight to environmental justice, economic and land-use impacts, and cost-effectiveness.	Each transit mode provides unique mobility options and is defined by unique operating characteristics that are not applicable to all communities in the MBTA service area. For these reasons, and because of the fiscally unconstrained nature and broad regional focus of the PMT, the MBTA has decided to create lists of high priority projects for each individual mode instead of a single high priority project listing for the entire system. The PMT Executive Summary does, however, provide information on the MBTA's highest immediate systemwide priorities, for which capital funding is already being pursued. Subsequent determinations of specific project-level funding priorities will continue to occur in the MBTA's Capital Improvement Program, as specified in the MBTA's enabling legislation. The MBTA and the PMT working committee developed performance measures over an 18-month open process.
		Installing bus shelters would improve bus ridership.	The PMT includes a project to install 300 bus shelters.
		Purchasing 100 new buses should be a high priority; they should not be used for Urban Ring Phase I; they should be used to expand capacity on existing, overcrowded routes	The PMT includes a project to purchase 100 new buses. These buses would be used to enhance existing service, not to initiate a new service. Urban Ring Phase 1 is a separate project.

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		and replace the dirtiest diesel buses in the fleet. Installing bus counters should receive higher environmental justice ratings; it is the only way to get an accurate count of ridership on MBTA buses, needed for planning.	Purchase of automatic passenger counters is now considered to be part of Intelligent Transportation Systems (ITS) installation. This project is considered a high priority service enhancement.
Andy Sumanadesa Traffic Engineer Town of Weymouth	03/18/03	As extending the Red Line to South Weymouth is rated as a low priority, the town recommends extending existing Route 225 bus service from Weymouth Landing to South Shore Hospital on Route 18 in South Weymouth.	Changes to MBTA bus routes which do not require a capital investment would be considered by the MBTA's Service Plan process, not the PMT.
Tony Fields, Chairman, North Suburban Planning Council	3/19/03	The Reverse Commute project analysis does not refer to the closing of Mishawum station for reverse commuting. The Council believes double tracking should be a high priority. The council would like the project to improve pedestrian access to Anderson RTC from West Side upgraded from medium to high priority. The Council supports improved pedestrian access to all rapid transit and commuter rail stations. The Council would like to see the definition of bicycle parking expanded so that the option of bicycle lockers or other forms of sheltered, secured parking are provided. Route 128 Circumferential Bus Service requires a detailed study which should be a high priority. The North Suburban Transit Opportunities Study should be referenced in the PMT. The council support extending the Orange Line to Reading if commuter rail service is retained between Boston and North Wilmington.	Mishawum station remains opened for several reverse commute trains. The PMT includes a project to install double track in existing single-track segments of the commuter rail network. All projects in the PMT were evaluated using consistent and objective criteria. The PMT includes a project to improve pedestrian access to Anderson RTC. All projects in the PMT were evaluated using consistent and objective criteria. The PMT includes a project to improve pedestrian access to rapid transit and commuter rail stations. The MBTA is working with EOTC and Mass Highway to analyze bicycle and pedestrian access to MBTA stations. The MBTA will consider the use of bicycle lockers. The council should make a request to the Boston MPO to include such a study in the 2004 UPWP. The North Suburban Access study identified possible shuttle bus services to commuter rail stations. This analysis was considered as part of the Suburban Commuter Rail Feeder analysis. The PMT includes a project to extend the Orange Line to Reading, however the analysis assumes that all commuter rail service north of Reading would be diverted via the "Wildcat Branch" and Lowell line to Boston. Service to North Wilmington would be discontinued.

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Joshua Channell	3/19/03	Supports the methodology used in developing the PMT. Particularly supports consideration for air quality and smart growth. Would like to make subway expansion projects high priority. The MBTA is an asset to the region.	Thank you for your comments. All projects in the PMT were evaluated using consistent and objective criteria.
Joe Beggan	03/19/03	The Silver Line extension west should operate on surface streets with transit priority improvements. A Blue Line extension to West Medford should include a station at North Station and include a connection to the Green Line	If the Silver Line West proposal is further developed, an alternative plan to operate via surface streets can be considered. If a Blue Line extension to West Medford is further developed, the exact location of stations can be further refined.
Jarret T. Barrios State Senator Middlesex, Suffolk, and Essex district	03/20/03	Supports the Urban Ring Supports extension of the Green Line to Union Square and Medford. Bus Route 86 should be extended to the Charlestown Navy Yard. Would like the MPO to prioritize the structural repair of the Sullivan Square overpass project.	The PMT includes a 3-phase project to construct the Urban Ring The PMT includes a project to extend the Green Line to Somerville, one of the possible routing alternatives under consideration includes a stop in Union Square. Changes to MBTA bus routes which do not require a capital investment would be considered by the MBTA's Service Plan process, not the PMT. This is a roadway repair project outside the purview of the PMT.
Lowell L. Richards, III, Chief Development Officer, Massport	3/20/03	Supports cost-effective efforts that improve access to airport for customers and employees, including: Silver Line beyond Phase II (completing connection to the South Boston waterfront) which should be one of highest priorities; surface service to BMIP (not using D Street between Northern Ave. and Summer Street). The Silver Line D Street grade separation should have a higher rating due to the at-grade impacts to service reliability. Keep Massport informed of progress on Red/Blue Line Connector studies. Extend the Blue Line from Wonderland to Lynn, and Massport will help identify New Starts funding. Supports the Urban Ring Phases I and II, with continued	The analysis of this project considered existing year 2025 demand for the service. Future PMTs can consider the impact of a full build-out on the street network and the resulting demand. The MBTA will keep Massport informed of the connector studies. The PMT includes a project to extend the Blue Line to Lynn. Funding strategies for proposed projects will be considered in greater detail as projects reach more advanced stages of planning and design. The PMT includes a project to construct the three-phase Urban Ring

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		coordination on use of Chelsea truck route.	project.
		Supports the expansion and enhancement of ferries serving Boston Harbor, including the East Boston ferry (with stops at Rowes Wharf, Russia Wharf, and the World Trade Center instead of Long Wharf) Make Harbor Express South Shore service a high priority. Improve Russia Wharf/South Station ferry service and other Inner Harbor services between Lovejoy Wharf and Charlestown and Russia Wharf/South Station, the Federal Courthouse, and World Trade Center. The Logan Dock has additional capacity.	The PMT includes projects to improve ferry service.
Anne Fanton, Executive Director and Robert Tuchman, Chair, Central Artery Environmental Oversight Committee	3/20/03	Change in table 2-2, 12/31/96 to 12/31/01.	The table has been changed.
		EOC does not view the Washington Street Replacement Service as complete as it is not connected to subway or light rail.	The Washington St. project has always been considered a separate phase of a multi-phase project. Phase 1 is complete.
		Make Blue Line track and platform improvements a high priority.	Improvements to the Blue Line have been included in past TIPs and CIPs. The PMT includes Blue Line improvements in the list of legal commitments found in Table 2-2
		System preservation projects should be given priority rankings (this will assist tracking and differentiation from enhancement and expansion)	The PMT is a financially unconstrained long-term capital planning document. The MBTA's annual Capital Investment Program (CIP) is the vehicle for identifying and implementing specific preservation projects.
		Priority station improvement projects should be identified; more information would better support the policy.	The PMT is a financially unconstrained long-term capital planning document. The MBTA's annual Capital Investment Program (CIP) is the vehicle for identifying and implementing specific station improvement projects.
		Text should refer to details found in the appendices.	Additional references to the appendix will be added to the test.
		Provide an explanation of how the performance measures were applied and how the inputs to the analysis were generated; explain why changes in ratings were made.	The Appendix includes a more detailed review of performance measures. The draft PMT was made available while final analysis work was still underway. Some numbers were later changed and will be reflected in the final version.
		Revise text on page 5B-31 "Access to Service", to read, "Capital expansion of commuter rail has also produced further demand for parking," to reflect that the	The text will be changed.

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		Commonwealth, not the regulatory agencies, offered to expand mass transit in the CA/T Project FEIS/R.	
		The MBTA implements the CA/T transit commitments it agrees with while delaying or making substitutes for others.	
		Clearly identify CA/T commitments for: Blue Line station improvements and Green Line station and track work at North Station.	Table 2-2 identifies CA/T commitments.
		Blue Line platform extensions for 6-car trains should be listed separately and rated.	The Blue Line platform work is an ongoing project. Wonderland, Revere Beach, Beachmont, Suffolk Downs, and Wood Island stations are complete. Work is presently underway at Airport and Aquarium stations. The remaining station work required at Orient Heights, Maverick, State, and Government Center has already been identified in the MBTA Capital Investment Program (CIP) and funded. The PMT includes Blue Line improvements in the list of legal commitments found in Table 2-2 These projects are included in the PMT as part of the total costs for station improvements in the System Preservation category.
		Note the assumptions and describe the data used in the evaluations on each project page and fully detail it in the appendices.	The PMT is intended to compare the relative merits of capital improvement project ideas only at a broad level of detail with a goal of categorizing projects in three tiers of ratings: high priority, medium priority, and low priority. If and when a particular project is advanced to serious consideration for inclusion in a regional capital programming document, more in-depth feasibility studies will be conducted that will provide a greater level of detail on costs, ridership impacts, and other performance indicators.
		Questions ridership and level of information used in the analysis of the Suburban Commuter Rail Feeder Bus Services and the Route 128 Circumferential Bus Service projects. Bus emissions from these projects should be factored into the air quality rating.	Bus emissions are factored into the air quality rating.
		Add a description of the Lovejoy Wharf to Russia Wharf connection as a version of the North-South Rail Link; it is	Once a facility is constructed at Russia Wharf, the MBTA's Service Plan

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		included in the January 1991 MEPA CA/T Certificate. Noting the East Boston ferry service as a high priority seem to be an error.	process will determine the specific route and level of service to be operated. The East Boston ferry is now designated as a medium priority project after completion of further analysis.
Jeffrey Levine, Chair, Inner Core Committee	3/20/03	Particularly supports: all three phases of the Urban Ring, Extension of the Green Line to West Medford, and construction of an Orange Line station at Assembly Square. Would like to see more information on the North-South rail link, electrification of commuter rail lines, Union Square station on the Fitchburg Line, and the commuter rail/Red Line connection at Alewife, and other (including UPWP) projects. Sees value in all of the enhancement and expansion projects.	The PMT includes all three phases of the Urban Ring, a project to extend the Green Line to West Medford, and a project to build an Orange Line station at Assembly Square. Additional information for each project can be found in the Appendix section.
Conservation Law Foundation	3/20/03	Develop a compelling 25-year vision; it should be used to advocate for the vision and increased funding for transit, including through flexing highway funds to transit. Refine the PMT performance measures. Include information on how project data is generated and show how analysis supports each rating. Quantitative inputs for analysis of all performance measures should be included. Supports the Environmental Justice and Economic and Land Use Impacts performance measures as important way to promote transit that supports equitable and sustainable development. Weight the performance measures. The addition of Travel Time Benefit evaluations helps counter emphasis on new riders. Update the PMT with transportation system user benefit analysis when possible. Move "Capital Cost Per Unit Reduction of VOC, Nox, and CO2 Emissions to Cost Effectiveness. "Percent Reduction of VOC, Nox, and CO2 Emissions should explain they are the result of VMT reductions. Define "Travel Time	The PMT includes an Executive Summary which address this. The MBTA decided, in conjunction with the PMT Working Committee, that each performance measure category would be weighted equally when applied to individual project ideas. These categories were, however, defined in such a way that reflected the priorities of the Working Committee, as a whole. For example, the ability of a project to generate ridership was effectively addressed in both the utilization and cost effectiveness categories. This approach allowed for a more simplified and transparent application of performance measures than would have been possible if direct weightings were applied to each measure. The MBTA and the PMT working committee developed performance measures over an 18-month open process. Changes to the performance measures used can be considered in the 2008 PMT.

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		Benefit" as "projected cumulative reduction in travel time experienced by all riders of the transit system". "Reduction in VMT should not be included in Utilization; it is already included in Air Quality. "Capital Cost Per Unit Travel Time Savings" should be defined as the projected cumulative reduction in travel time experienced by all riders of the transit system. Include background information proposed by CLF on Central Artery commitments. Update table 2-2 to include revised commitments and deadlines of the September 2000 Administrative Consent Order and the April 2001 amendment, other deadlines and project status. Add commitment and status information to project descriptions. Extend the review process to allow for these revisions.	The MBTA is working to include elements of CLF language and some changes have been made to table 2-2. The review process was extended by one week.A further extension would have prevented the use of the PMT in developing the Boston MPO's Regional Transportation Plan for 2003
Terry Brennan	03/21/03	Supports Green Line branch to Needham Junction	The PMT includes a project to construct a Green Line branch to Needham Junction.
Stephane Geuns-Meyer	03/21/03	Legal commitments including the Green Line to West Medford should be identified in the text. Legal commitments should be considered in the priority weighting. Supports the Urban Ring as a high priority. Please revise document to have two, at most three significant figures for every number. Daily ridership should be calculated for a period of time after an extension is estimated to be in operation. West Medford extension of Green Line should be evaluated with the context of a completed Urban Ring	Chapter 2 of the PMT includes a list of legal commitments and the present status of each project. A project's status as a legal commitment was used as an initial screening criterion for the PMT universe of projects. Consequently, all legal commitments were included in the PMT, and are thus eligible for programming in the Capital Improvement Program (CIP). The actual order of implementation for capital improvement projects is determined by the CIP - not the PMT. The PMT evaluates projects according to consistent and objective criteria, and this project did not rate as highly as others based on those measures. The PMT includes the Urban Ring. The MBTA will round-off figures in the PMT to a lesser level of precision. Model projections are based on 2025 ridership for a mature service. All projects are compared individually to the present base in order to offer a fair comparison. When and if the project reaches an advanced stage, the impacts of other transit projects that have also been advanced can be

Contact	Date	Summary	Response
			considered in ridership estimates.
Heidi Roddis Ricci Mass Audubon Society	03/21/03	The Society supports the North-South Rail Link	The PMT includes the North-South Rail Link project
Denise Provost City of Somerville Alderman At Large	03/21/03	Union Sq. should be linked to Boston by rapid transit, probably a branch of the Green Line. Urges the MBTA to look at all assets of the area when considering an Assembly Square Orange Line stop. The extension of the Green Line through Somerville to West Medford is a positive obligation of the Commonwealth, why are we not seeing its planning and design process now?	The PMT includes a project to extend the Green Line to Somerville, one of the possible routing alternatives under consideration includes a stop in Union Square. The PMT includes a project to construct an Orange Line station at Assembly Square. A project's status as a legal commitment was used as an initial screening criterion for the PMT universe of projects. Consequently, all legal commitments were included in the PMT, and are thus eligible for programming in the Capital Improvement Program (CIP). The actual order of implementation for capital improvement projects is determined by the CIP - not the PMT.
Dorothy A. Kelly Gay Mayor, City of Somerville	03/21/03	The employment and population projections in the final version of the PMT underestimates the amount of planned and projected growth in the Assembly Square district. Bringing rapid transit to Union Sq. with either a Green Line or Blue Line extension should be considered the preferred route, not an alternative. The city is pleased at the high rating of a new commuter rail station in Union Square. This station should not be viewed as a substitute for viable rapid transit access in Union Square. Urban Ring phase III is erroneously shown beginning at Sullivan Square instead of Assembly Square or Wellington. The evaluation the proposal to operate 8-car trains should consider the impacts of an Assembly Square station.	CTPS travel demand forecasts utilize population and employment growth projections generated for the MPO by the Metropolitan Area Planning Council (MAPC). After further analysis, the Assembly Square Orange Line station has been rated as a medium priority project. The PMT includes a project to extend the Green Line to Somerville, one of the possible routing alternatives under consideration includes a stop in Union Square. The commuter rail station is considered as a separate project from rapid transit proposals serving Union Square. The map has been corrected. All projects are compared individually to the present base in order to offer a fair comparison. When and if the project reaches an advanced stage, the impacts of other transit projects that have also been advanced can be considered in ridership estimates.
Wig Zamore	3/21/03	Asks that the Urban Ring (single technology) be given top priority.	The PMT includes the three-phase Urban ring project. All projects in the PMT were evaluated using consistent and objective

Contact	Date	Summary	Response
			criteria.
		Supports the North-South Rail link; it will take cars off the road and improve air quality	The PMT includes a project to construct the North-South Rail Link
		Suggests that the Green Line Extension to Medford Hillside might not meet its deadline and suggests that instead, the Green Line be extended to Union Square, linked with adjacent roadway improvements and development.	The PMT includes a project to extend the Green Line to Somerville, one of the possible routing alternatives under consideration includes a stop in Union Square.
		Notes Somerville's many transportation burdens; and high population density, current transit use, and modest median income levels.	The PMT includes a project to construct a commuter rail station on the Fitchburg Line at Union Square, Somerville. The PMT includes a project to extend the Green Line to Somerville, one of the possible routing alternatives under consideration includes a stop in Union Square.
		Requests that the Orange Line station at Assembly Square be a very high priority, consistent with local employment oriented mixed use development goals; this would save 100 million VMT's per year.	The PMT includes a project to construct an Orange Line station at Assembly Square. All projects in the PMT were evaluated using consistent and objective criteria.
		Construct new commuter rail stops along the Lowell Line.	The existing universe of projects was developed over an 18-month period. The deadline for adding a new project to the existing PMT has passed, however new projects to add commuter rail stops along the Lowell line can be added to the universe of projects for the 2008 PMT.
William Newton, Executive Director, Central Massachusetts Regional Planning Commission	3/21/03	Supports: 1.) more frequent service between Framingham and Worcester. Address the increasing demand for service. Also, expand the Worcester layover, upgrade the signal and track in the corridor, improve agreements with CSX. 2.) the extension of commuter rail from Forge Park to Milford, including a station in Bellingham. There is identified need for this service in the Blackstone Valley. 3.) a new station at Millbury on Framingham/Worcester Line; ridership estimates in the PMT are low.	The PMT includes a project to operate more frequent service between Framingham and Worcester. The PMT includes a project to extend commuter rail from Forge Park to Milford with a stop in Bellingham. The PMT includes a project to construct a station in Milbury on the Worcester line. Ridership estimates do account for the location of turnpike Exit 11. All projects in the PMT were evaluated using consistent and objective criteria.
Sean Sullivan, Arborway Rail Restoration Project Advisory Committee	03/21/03	Give additional weight to high frequency/high speed transit expansion projects as this mode reduces the region's auto dependency and results in many	The MBTA and the PMT working committee, as part of an 18-month process to develop performance measures, determined it was best not to apply any weights to measurements. Changes to the performance measures

Contact	Date	Summary	Response
		environmental and social benefits.	used can be considered in the 2008 PMT
		The Silver Line is the only expansion project likely to increase HF/HS service and this shows that the methodology must not be balanced. Current methodology evaluating projects by considering new ridership disadvantages these HF/HS projects as they are likely to draw riders from existing transit. This methodology passes over HF/HS projects that could be implemented at a reasonable cost and would greatly expand coverage.	The travel time savings analysis is intended to reflect the benefits a new project would bring to existing riders, and considers the impact on all riders.
		Suggests new projects for the Universe: 1.) Replace or supplement the Yawkey shuttle with a new project, the Readville/Riverside shuttle, (high-frequency Readville-Allston Landing commuter rail and extend service to Newtonville, West Newton, Auburndale and new Riverside stations,) that would combine several proposed projects and bring HF/HS service to new stations. Does the Readvillle/Allston shuttle include the upgrade of Fairmount Line stations? 2.) Extend Orange Line service to Wyoming station, involving conversion of one commuter rail track and the Wyoming commuter rail station to Orange Line use, bringing HF/HS service to Melrose. 3.) Extend the Orange Line to Roslindale or West Roxbury instead of Needham, a more economical project that would improve air quality, and increase transit ridership.	The existing universe of projects was developed over an 18-month period. The deadline for adding a new project to the existing PMT has passed, however new projects can be added to the universe of projects for the 2008 PMT.
		Several operations might mitigate Green Line congestion: operating Riverside/Needham cars on the same train unit east of Newton Highlands; or a Newton/Needham Shuttle; or Needham trains or split vehicles via Beacon St. or at Kenmore.	The PMT includes a project to extend Green Line service to Needham. If this project is pursued, operational details can be considered as part of a more in depth project analysis.
		Extend #71 bus to Newton Corner.	The PMT includes a project to extend Route 71 to Newton Corner.
		Suggests careful consideration of the impacts of eliminating any commuter rail stations.	
		Highway funds should be used for the Route 128 HOV lanes.	The PMT is a financially unconstrained capital planning document.

Contact	Date	Summary	Response
		Supports ITS improvements for buses. Does not support double tracking the entire commuter rail system. Four-car Green Line trains would increase capacity in the central subway and attract new riders.	Therefore, it does not provide funding for project implementation. The PMT does consider the use of highway dollars as pat of overall funding strategies identified in Chapter 4. The PMT includes a project for ITS improvements for buses Ridership projections are based on 2025 demand and do not place capacity restrictions in the projections.
Nicole Jabaily MASSPIRG	3/21/03	Seeks to curb air pollution by improving and expanding MBTA. Has concerns about process and criteria for determining priorities: the weighting of performance measures is ambiguous; air quality and land use should be given more weight; cost effectiveness should be determined through capital costs and operating costs per passenger, not new passengers only; utilization should consider total riders, not just the increase. Make conversion to light rail of the Dudley-Boylston Silver Line segment a high priority; it would improve air quality where greatly needed. Expresses concerns that the Urban Ring Phase III will never be upgraded from bus to light rail. Supports the North/South Rail Link as a high priority.	The PMT includes MBTA expansion projects. The MBTA and the PMT working committee, as part of an 18-month process to develop performance measures, determined it was best not to apply any weights to measurements. Changes to the performance measures used can be considered in the 2008 PMT The travel time savings analysis is intended to reflect the benefits a new project would bring to existing riders, and considers the impact on all riders. The PMT includes a project to convert the Washington Street segment of the Silver Line to a Green Line branch. The development of the Urban Ring project has been the subject of an extensive public process prior to the PMT. The PMT includes those proposals generated from that process. The PMT includes a project to construct the North-South Rail Link.
Robert W. Healy, City Manager, City of Cambridge	3/25/03	States that projects that ensure that transit ridership in the inner core remains strong should have priority over commuter rail service. Supports the following projects: Red Line Signal and Train Control Improvement; Install 300 Bus Shelters; improved access to stations for pedestrians and cyclists (suggests the MBTA conduct pilot programs in collaboration with communities); and Urban Ring all phases.	All projects in the PMT were evaluated using consistent and objective criteria.

Contact	Date	Summary	Response
		Asks:	
		for more information on reductions in fare and sales tax collections;	Analyzing changes in fare and sales tax collections is outside the scope of the PMT.
		if bus shelters will increase boardings;	No information is available to indicate what impact on ridership the installation of bus shelters would have.
		if there is a relationship between the Red Line Signal Improvements and the 8-Car Train projects.	The projects to improve Red Line signals and to operate 8-car trains on the Red Line are independent of each other. They are two alternative approaches to increasing capacity to meet demand by 2025. Implementing both projects would increase capacity beyond expected demand.
		Expresses concerns that the Minuteman Bikeway might be closed permanently if a Red Line Extension to Route 128 were implemented.	If a project t extend the Red Line north of Alewife is pursued, more detailed analysis would determine the possible temporary or permanent impacts on the bikeway.
Public Hearing Oral Comments			
March 5, 2003			
Menno Koening, MAPC Representative to South West Advisory Planning Committee		See written comment above.	The PMT includes a project to extend commuter rail to Millis.
Fred Moore, The Association for Pubic Transportation (APT)		APT endorses the Fairmont Line.	The PMT includes a project to upgrade the Fairmount Line.
		Asks the MBTA to make the Red-Blue Connector a higher priority; look at connections to Alewife, Cambridge, or Lynn.	The PMT includes a project to extend the Blue Line to Charles. All projects in the PMT were evaluated using consistent and objective criteria.
		Move forward with the automated fare collection.	The MBTA has initiated the procurement of new fare collection equipment.
		Set up a spider web system for suburban bus service.	Changes to MBTA bus service which do not require a major capital investment are studied under the MBTA's Service Plan process.
		Expedite expansion of the Riverside Line light rail.	The PMT is a financially unconstrained capital planning document. Therefore, it does not provide funding for project implementation.
		Make the Silver Line phases lower priorities.	All projects in the PMT were evaluated using consistent and objective criteria.
		Do not pursue the Lynn ferry service.	
		Give the Millis project a higher priority than Fall	All projects in the PMT were evaluated using consistent and objective

Contact	Date	Summary	Response
		River/New Bedford. Make service expansions outside the former MBTA district a priority. Thinking of the commuter rail system as "regional rail" supports the concept that the stations could be destinations; it has great potential. Increase frequency on a three-branch system serving the North Shore. The PMT process has been very open; we can see how decisions are made.	criteria. All projects in the PMT were evaluated using consistent and objective criteria.
Carolyn Manson		See written comment above.	
Bill Tedoldi, Needham Board of Appeals, and Charles River Watershed Association		Make the Millis extension a high priority. Transit, particularly rail expansion, is an important way to help manage sprawl; through transit-oriented design.	The PMT includes a project to extend commuter rail service to Millis. All projects in the PMT were evaluated using consistent and objective criteria.
Roland Hebert, Southeast Regional Planning and Economic Development District		Supports the high priority ranking given the Fall River/New Bedford commuter rail project. It will serve two major cities and a region with more than 90,000 people. Supports improvements to stations in Mansfield and Attleboro; the intermodal transit center and parking garage in downtown Attleboro. The South Attleboro station needs a parking deck. Keep the Middleborough to Wareham commuter rail extension a medium priority.	The PMT includes a project to extend commuter rail to Fall River and New Bedford. The PMT includes evaluations of parking expansion needs throughout the entire system. The PMT includes a project to extend commuter rail to Wareham.
Tony Wai Tommee, New Transit, Northeastern University Transit Club		Make providing warning and delay information on the Green Line and at bus stops a high priority. Add a commuter rail station at Newton Corner; it would be a strategic location.	The existing universe of projects was developed over an 18-month period. The deadline for adding a new project to the existing PMT has passed, however a new project to construct a commuter rail station at Newton Corner can be added to the universe of projects for the 2008 PMT.
John Deacon, Sierra Club		Show the Central Artery commitments in a separate list.	Table 2-2 lists Central Artery commitment projects.

Contact	Date	Summary	Response
		Evaluate the Red-Blue Connector, the Silver Line, and Fall River/New Bedford as bus rapid transit projects.	The existing universe of projects was developed over an 18-month period. The deadline for adding a new project to the existing PMT has passed, however projects to construct a Bus Rapid Transit line between Bowdoin and Charles/MGH; to construct a Bus Rapid Transit system from Boston to New Bedford and Fall River; and to electrify the Fairmount line can be added to the universe of projects for the 2008 PMT.
		Check the methodology for the Arborway evaluations; the ridership will be much higher than projected; make it a high priority.	All projects in the PMT were evaluated using consistent and objective criteria.
		Restore the Silver Line as a rail line. Show the ridership projections for the Silver Line. The replacement transit has not been accomplished; the bus rapid transit service does not meet rapid transit standards. Separate the Transitway-to-Boylston section from the line.	The PMT includes a project to convert the Washington Street segment of the Silver Line to a Green Line branch.
		The diesel buses are concentrated in one area and their emissions pose a health risk.	The MBTA has ordered 343 additional CNG buses.
		Include a dual mode vehicle for the North/South Rail Link project.	The North-South Rail Link project includes dual-mode vehicles.
		Make the Orange Line station at Assembly Square a high priority.	The PMT includes a project to construct an Orange Line station at Assembly Square.
		Focus on a Green Line station at Union Square, not commuter rail.	The PMT includes a project to extend the Green Line to Somerville, one of the possible routing alternatives under consideration includes a stop in Union Square.
		Electrify the Fairmont Line.	The PMT includes a project to electrify all commuter rail lines. Electrification of a single line can be considered in greater detail if this project advances.
		Build a stairway on the other side of the Anderson Regional Transportation Center.	The PMT includes a project to improve pedestrian access to the Anderson Regional Transportation Center.
Divah Payne		Replace the rapid transit in the Washington Street Corridor. The bus shelters don't shelter people. The buses are poorly designed for the handicapped and elderly. Seats are cheap, poorly situated, unmarked, cramped.	The design of shelters currently used at Silver Line stations was a product of both the MBTA and a community advisory committee to the Mayor of Boston. As a result, no substantial modifications are expected. MBTA low-floor buses are built to standard transit industry designs.

Contact	Date	Summary	Response
		Construction diversions are unfair to (do not make accommodations for) elderly and handicapped. The Ride operations need to be improved. The operators don't communicate with you and are often not on time or at the time you requested. Some drivers have been verbally abusive.	Complaints of poor performance from Ride operators have been forwarded to the Office of Transportation Access.
Toni Hicks, Conservation Law Foundation		Priority ratings should be more prominent. Do an overview, including a summary of all projects and their ratings. The description of the legal commitments should be expanded to include discussion of the Central Artery permitting. Update the list of legal commitments, including the 2001 amendment. Include deadlines when tracking the status of legally required projects and substitution criteria. The use of performance measures for environmental justice and economic land use results shows that urban core projects are valued. There should be more transparency for the link between the performance measures and the outcomes.	Appendix A of the PMT includes a description of PMT performance measures and how they were applied. The PMT includes an Executive Summary which includes a summary of projects. Appendix C of the PMT provides detailed results for each project evaluated in the PMT. Legal commitment language has been changed. Appendix A of the PMT includes a description of PMT performance measures and how they were applied.
John Kyper		See written comment above.	
Gene Gobby, the Allston-Brighton CDC Design Environment Committee, and the Association for Public Transportation		Analyze whether a stop in Allston-Brighton would reduce traffic. Promote commuter rail for tourists. The bus from South Station is an excellent way to get to South Boston. Use ramps at stops instead of the Green Line Breda cars, which are poorly designed and dangerous. Consider the design issues for passengers who are short.	The PMT includes a project to construct a commuter rail station in Allston. Your concerns about the Breda cars will be forwarded to Green Line Operations.
Peter Griffin, New Hampshire Railroad		Extend commuter rail from Newburyport to Kittery, Maine; from Lawrence to Manchester, New Hampshire.	Projects to extend commuter rail to Kittery and to Manchester and to restore the Saugus branch were removed during the pre-screening process

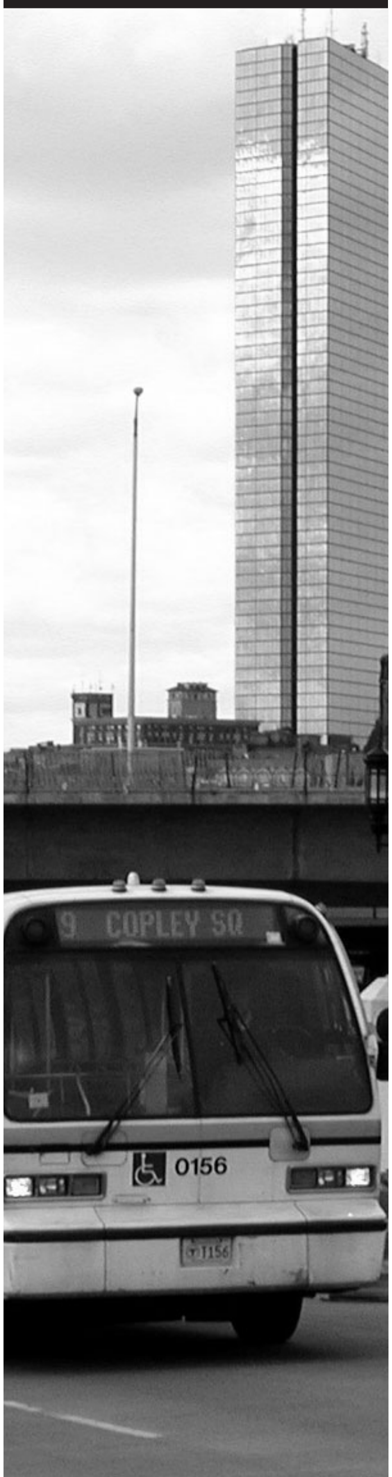
Contact	Date	Summary	Response
Revitalization Association		Explore accommodating double stack freight service to the Port of Boston. Maintain the Saugus Branch as an active rail corridor. Evaluate North Station rail and ridership capacity.	of the PMT. It is outside the purview of the PMT to consider improvements for freight transportation. The PMT includes a project to expand the waiting area at North Station.
Bill Walker, Water Transportation Alternatives		See written comments above.	
Jeremy Marin, Sierra Club		Supports the North/South Rail Link. Use existing light rail tunnels for the Silver Line.	The PMT includes a project to convert the Washington Street segment of the Silver Line to a Green Line branch. The PMT includes the North-South Rail Link project
March 6, 2003			
Melissa Marantz, MASCO		See written comments above.	
Mike McGurl, Water Transportation Alternatives		Make the expansion of water transportation to the South Shore a high priority; it is cost effective, reduces air pollution, provides quality service. Change routing of MBTA buses along Route 3A to stop at the Quincy commuter boat dock.	The PMT includes a project to improve ferry service from South Shore communities to Boston. All projects in the PMT were evaluated using consistent and objective criteria. Changes to local bus service are made through the MBTA's Service Plan process.
Paula Walach		Supports use of electric transit vehicles. Purchase electric trains. Electrify the Attleborough Line. Commuter rail schedules should be adjusted to serve other than 9-5 workers. Install bike racks on trains	The PMT includes a project to operate electric powered equipment on the Attleborough line. The PMT includes a project to install bike-racks on commuter rail trains. Changes to specific train schedules are made through the MBTA's Service Plan process.
Gill Wooley, Sierra Club		Washington Street replacement is the number one priority. Make the Silver Line light rail. Opposes the bus tunnel from Chinatown to Boylston. Supports the North/South Rail Link.	The PMT includes a project to convert the Washington Street segment of the Silver Line to a Green Line branch. The PMT includes the North-South Rail Link project
Scott Darling, Conservation Law Foundation		Put information about the priority rankings and project definitions in the front of the document. Create a clear introduction and description for legal commitments, their funding, and deadlines.	Appendix A of the PMT includes a description of PMT performance measures and how they were applied. Appendix C of the PMT provides detailed results for each project evaluated in the PMT. Legal commitment language has been changed with input from CLF.

Contact	Date	Summary	Response
		Supports the use of the environmental justice and economic land use performance measures; they support the urban core. Project evaluations should be more transparent. Some performance measures (utilization, cost per unit reductions) do not make sense. Reliability of service should be highlighted. Extend the public comment period by thirty days.	The PMT includes these performance measures. Appendix A of the PMT includes a description of PMT performance measures and how they were applied. Consideration of reliability is included under the service quality performance measure. The review process was extended by one week.A further extension would have prevented the use of the PMT in developing the Boston MPO's Regional Transportation Plan for 2003
Wig Zamore, Mystic View Task Force		Supports the Green Line extension to Medford Hillside. Construct temporary commuter rail stops in Somerville. Bring the Green Line to Union Square as a substitution for full extension. Get state and federal funding for an Orange Line station at Assembly Square. There should be a balance between urban and suburban projects in the PMT. Supports the North/South Rail Link. Use a single mode (light or heavy rail) for every phase of the Urban Ring; it is a very important project. Somerville bears a heavy burden of transportation infrastructure and environmental and community impacts and gets little direct service.	The PMT includes a project to construct a commuter rail station on the Fitchburg Line at Union Square, Somerville. The PMT includes a project to extend the Green Line to Somerville, one of the possible routing alternatives under consideration includes a stop in Union Square. The PMT is a financially unconstrained capital planning document. Therefore, it does not provide funding for project implementation. All projects in the PMT were evaluated using consistent and objective criteria. The PMT includes a project to construct the North-South Rail Link. The development of the Urban Ring project has been the subject of an extensive public process prior to the PMT. The PMT includes the project descriptions generated from that process.
Jack Leary, Massachusetts Bay Commuter Railroad Company		Supports investments in the state of good repair; will work with the MBTA in its decision-making on transportation investments; will preserve system safety and improve system reliability. Supports projects that improve operational flexibility; additional track to permit express services; multi-modal	The PMT includes a project to double-track single-track segments of the commuter rail network.

Contact	Date	Summary	Response
		access improvements to stations.	
Ginger Esty, Town of Framingham		Suggests the MBTA divide into three branches: bus, rail, commuter boat, to improve financial management.	It is outside the purview of the PMT to change the organizational structure of the MBTA.
Roger Nicholas		Develop a modern transportation system.	The MBTA has set a policy that at least 70% of its annual capital expenditures will go toward preserving the existing system.

APPENDIX E

Universe of Projects



As part of the PMT visioning phase described in Chapter 1, the MBTA developed the Universe of Projects–the set of all projects considered in the PMT. An important part of this effort was the project-level review of previous PMTs and other MBTA planning documents, the Capital Investment Program, the State of Good Repair Program, the Parking Expansion Program, and other various studies conducted to support capital investment planning by the MBTA. The 2000–2025 Regional Transportation Plan was also reviewed. The results of this work provided the essential, baseline inputs to the set of projects considered for inclusion in the PMT. Extensive public outreach and review by the Working Committee, the MBTA Advisory Board, and members of the public yielded hundreds of project ideas to supplement this initial list.

After the universe of project ideas was developed, the MBTA and the PMT Working Committee screened the list to create a smaller and more viable group of projects that warranted further evaluation. A set of criteria, reviewed with the Working Committee and the MBTA Advisory Board, identified issues to be considered in this screening process. These criteria, along with the performance measures described in Appendix A, are consistent with the MBTA's amended enabling legislation.

The screening criteria included a project's ability to meet an identified need or an existing legal commitment. Environmental justice issues, such as ensuring equitable provision of service to minority and low-income communities, were also taken into account, along with whether a project was included in the 1994 PMT. Community support and coordination with local plans were considered. Concepts that were technically infeasible, currently impracticable, or inconsistent with established MBTA transit priorities were screened out. In addition, those project ideas that did not require additional capital resources for implementation were referred to the MBTA's service

planning process. All system preservation projects were forwarded for further evaluation without undergoing screening.

At the end of the visioning phase, the PMT team had developed a universe of project ideas which is shown on the following pages.

An * indicates projects that were screened out and did not warrent further evaluation. Justifications are provided in italics.

SYSTEM EXPANSION PROJECTS

Blue Line

Blue-Red connector

Wonderland Blue Line-commuter rail connector

Extension to Lynn

Extend from Bowdoin to Copley/Back Bay and then to Riverside, replacing the Green Line D Branch*
This project was found to be cost-ineffective in the 1994 PMT. There is nothing to suggest that this conclusion would change in the 2002 PMT. Furthermore, the City of Boston has expressed its support for consideration of an alternative new east-west rapid transit line through the Back Bay along Stuart Street.

Build spur direct to airport*
This project was rejected in a previous North Shore transit improvement study. Furthermore, the Airport Intermodal Transit Connector will soon be operational and will serve the same markets that such a Blue Line spur would.

Build a spur to Winthrop *
Existing transit service in Winthrop does not suggest that there would be sufficient demand for rapid transit service. Furthermore, the operation of such a spur would result in less frequent service to existing Blue Line stations east of Orient Heights.

Build a spur to Chelsea and Everett*
Such a service would serve a number of the same crosstown transit markets that the Urban Ring is intended to serve. Given the advanced status of the Urban Ring Major Investment Study and substantial public support for its construction, this potential Red Line improvement will not be examined in greater detail in this PMT.

Extend to Salem

Extension from Bowdoin to West Medford via Lechmere and Somerville

Orange Line

Extension from Oak Grove to Reading/Route 128

Extension from Forest Hills to West Roxbury/Needham

Extend to Route 128 at both ends

Extend to Saugus*
Existing transit ridership in the area that would be served by this Orange Line branch does not suggest that there is adequate demand for rapid transit service. Furthermore, the North Shore Major Investment Study Steering Committee, which includes a number of community representatives, has voiced its opposition to consideration of this project.

Build spur to Chelsea and Everett

Build a spur to Chelsea*
Such a service would serve a number of the same crosstown transit markets that the Urban Ring is intended to serve. Given the advanced status of the Urban Ring Major Investment Study and substantial public support for its construction, this potential Red Line improvement will not be examined in greater detail in this PMT.

Construct station at Assembly Square

Red Line

Extension beyond Ashmont to Mattapan in place of present streetcar service*
Communities along the Mattapan High-Speed Line have expressed a strong desire to preserve the historic streetcar service, especially with the MBTA's

recent commitment to rebuilding existing PCC trolleys. Furthermore, many passengers would be inconvenienced by the elimination of four of the six intermediate stations if the line was converted to heavy rail rapid transit.

Northwest Extension: Alewife-Arlington Heights-Lexington

Red Line loop to serve South Boston waterfront*
A large portion of such a Red Line loop would duplicate Silver Line service currently under construction from the new convention center to South Station. This project idea may be reconsidered in future PMTs once the Silver Line is open and its impact on travel in the area can be measured.

Extend from Alewife to Route 128 via Route 2

New variation from Central Square, Cambridge to JFK/UMass via Massachusetts Avenue*
Such a service would serve a number of the same crosstown transit markets that the Urban Ring is intended to serve. Given the advanced status of the Urban Ring Major Investment Study and substantial public support for its construction, this potential Red Line improvement will not be examined in greater detail in this PMT.

Extend from Braintree to Randolph*
Existing commuter rail ridership in this corridor does not suggest that there is adequate demand for such an extension to the rapid transit network.

Replace light rail service with busway on Mattapan High Speed Line*
Communities along the Mattapan High-Speed Line have expressed a strong desire to preserve the historic streetcar service, especially with the MBTA's recent commitment to rebuilding existing PCC trolleys.

Extend to Weymouth via Plymouth/Kingston Line right-of-way

Add a stop on the Braintree branch at Savin Hill Station*
Existing transit ridership at Savin Hill Station does not suggest that there is adequate demand for both branches to stop there. The cumulative negative travel time impact to existing South Shore Branch customers would far outweigh the benefits of increased frequency to Savin Hill Station customers.

Green Line

Reopen Arborway-Heath Street segment

Green Line to Brighton (Watertown Line)*
Restoration of the former Green Line A Branch would face numerous challenges to providing handicapped accessibility in mixed traffic. Instead, a Silver Line western spur will be examined in detail as part of the PMT and would serve many of the same destinations in Allston and Brighton.

Brookline Village Connector (D Line-E Line)*
According to the 1994 PMT, there has been a considerable amount of new construction in the Brookline Village area since 1978. As a result, construction of this connector would face prohibitive technical challenges.

Green Line to Needham (branch from Riverside Line after Newton Highlands)

Urban Ring: Construct a transit system following a circular route around the inner core

Extend Riverside Line to Wellesley*
Existing commuter rail service in Wellesley does not indicate that there would be adequate demand for a parallel rapid transit service. This PMT will, however, examine the potential for a commuter rail–rapid transit connection between the Framingham/Worcester Line and the Green Line at Riverside Station to provide better transit access from western suburbs to Newton and Brookline.

Extend Green Line from Lechmere to Harvard Square via Union Square, Somerville*
Existing transit service connecting Lechmere, Union, and Harvard Squares does not indicate that there would be adequate demand for streetcar service on such a routing. A Green Line extension to West Medford via Union Square will, however, be examined as part of this PMT.

Extend Green Line from Lechmere to Saugus*
The areas that would be served by this Green Line branch are either (1) already served by Orange Line service, or (2) do not generate enough ridership on existing bus service to suggest that a new rapid transit line would be cost-effective. Furthermore, the North Shore Major Investment Study Steering Committee, which includes a number of community representatives, has voiced its opposition to consideration of a similar rapid transit expansion, using heavy rail vehicles instead.

Convert Silver Line between World Trade Center and South Station to light rail and connect to Green Line at Boylston*
The Silver Line between World Trade Center and South Station is already under construction and will be operated using buses. However, the underground portion of the line is being constructed such that light rail conversion would be possible in the future. This project idea may be considered in a future PMT after actual service performance of the new Silver Line can be assessed.

Build a new branch from North Station to Boylston via the Waterfront and South Station*
Such a branch would serve markets that either the North-South Rail Link or a surface transit line in the Central Artery right-of-way is intended to serve. Given that this right-of-way would facilitate construction of a new north-south rapid transit line in downtown Boston, a waterfront routing will not be considered in greater detail in this PMT.

Extend the proposed Medford Hillside extension from Medford Hillside to Davis Square to connect with Red Line*
Existing feeder bus service from Medford Hillside to Davis Square operates efficiently under present conditions, and streetcar service is unlikely to provide substantially better travel times, reliability, or service frequency.

Extension from Lechmere to West Medford via Somerville

Silver Line

Build South Station-Boylston section of Silver Line (Silver Line Phase III)

Extend Silver Line from Dudley Station to Mattapan and Ashmont Stations

Extend Silver Line from Boylston Station to Kenmore Station via new subway under Stuart Street and operate two western branches: one to the Longwood Medical Area and one to Oak Square, Brighton via Allston Landing

Extend Silver Line from Convention Center to City Point via Summer Street and East Broadway

Convert Washington Street Silver Line to trackless trolley or light rail and extend to Mattapan via Grove Hall

Operate branch from Forest Hills to Dudley via Washington Street*
Most of the market that would be served by such a branch is already within walking distance of the Orange Line. Furthermore, existing bus service along this corridor does not generate adequate demand to warrant consideration of rapid transit service.

Commuter Rail

Expand reverse commute options

Fairmount Line improvements/Indigo Line

Extend Providence Line to T. F. Green Airport (RI)

Reconstruct rights-of-way and extend service from Stoughton to New Bedford and Fall River via Taunton

Reconstruct tracks and extend service from Needham Junction to Millis

Extend service from Lowell to Nashua with stop at North Chelmsford

Extend service from Middleborough to Wareham

Extend passenger rail service from Wareham to

Hyannis

Extend service from Fitchburg to Gardner

Extend service from Forge Park to Milford

Extend service from Salem to Peabody

Institute a new line from Worcester to Providence*
Such service would generate low demand. Any such connection would be the responsibility of the Worcester Regional Transit Authority.

Institute a new line from Worcester to Haverhill*
Such service would generate low demand.

Build Central Massachusetts (Waltham to Berlin via Weston, Wayland, Sudbury, and Hudson) commuter rail or busway*
Currently, the local communities have expressed their preference for a bikepath along this corridor, and therefore this proposal, at this time, does not support the local plans for this right-of-way. Future PMT's may consider transit improvements for this corridor.

Build Alewife commuter rail station

Build Allston/Brighton commuter rail station

Build commuter rail station at Riverside and intermodal transfer facility between commuter rail and Green Line

Build regional commuter rail station on I-495 in MetroWest area

Build regional commuter rail station along Route 2 at or near I-495

Purchase hybrid bus-train vehicles that would have both steel and rubber wheels to operate on Framingham-Worcester Line*
Given that such vehicles are not currently in regular passenger service in the United States or abroad, the technical complexity of implementing this idea in a corridor without proven substantial demand for traditional feeder bus service would be prohibitive.

Make improvements to the Foxborough commuter rail station to accommodate regular commuting trips, and open stadium parking facilities to park-and-ride customers

Connect the Fairmount Line to the Red Line at Mattapan*
This project does not support local plans that favor an upgrade of Fairmount Line service.

North-South Rail Link: Construct a commuter rail tunnel connecting the north side and south side networks with stops at North Station, South Station, and possibly an intermediate location

Build a new commuter rail connection from North Station to South Station via Logan Airport*
This option does not support local and regional plans. This improvement was considered and eliminated within the North-South Rail Link planning process.

Build a rail line from Framingham to Leominster via Northborough and Southborough

Operate service from Worcester to North Station via Cambridge over the Grand Junction line, with stops at Boston University, Massachusetts Institute of Technology and East Cambridge*
This project does not support local plans for this area, since the Urban Ring planning process incorporates this right-of-way into its proposed service.

Commuter rail "Inner Ring": Melrose to Winchester*
This project is technically infeasible. Such service would likely also generate low demand using this mode choice.

Extend Newburyport trains to Kittery, Maine*
This extension is technically complex, and it does not support the current plans of Massachusetts and New Hampshire.

Extend commuter rail from Haverhill to Plaistow, NH

Build commuter rail spur from Framingham to Sudbury Center*
Such service would generate low demand.

Extend commuter rail from Worcester to Springfield*
Such service would generate low demand. This project would not fall within the MBTA's current service area.

Restore Saugus Branch from Malden to Lynn via Saugus*
This project poses significant environmental, social, and physical impacts to the communities along the new alignment, as well as potential operational issues that would negatively impact the level of commuter rail service already provided. Furthermore, during public outreach for the North Shore Major Investment Study, the Cities of Malden and Everett stated that this project is inconsistent with the "Bike to the Sea" concept favored by these municipalities.

Operate service from Boston to Route 1 in Peabody (branch off of Haverhill Line at Wakefield)*
This project does not support local plans that have been developed within the North Shore Major Investment Study planning process.

Operate to Danvers (branch from Salem)

Add South Salem stop

Add a new station at Millbury on Framingham/Worcester Line

Add a station at Route 128 on the Needham Line*
The PMT is considering such a service through an Orange Line extension.

Operate high-frequency Riverside-JFK/UMass commuter rail service

Operate high-frequency Riverside-South Station commuter rail service

Operate high-frequency Readville-Allston Landing commuter rail service

Build new spur from South Weymouth Station into old Air Base*
Such service would generate low demand and would result in reduced frequency to the Kingston and Plymouth terminals.

Restore Randolph Branch through Randolph Center*
The MBTA already supplies service to Randolph, and this project is not likely to generate significant additional demand.

Build a station in West Acton on Fitchburg Line*
The communities along the Fitchburg Line have clearly stated the need for shorter trip times into/out of Boston. An additional station on this line would further deteriorate the quality of service by adding additional time to the current trip.

Extend proposed Greenbush line from Scituate to Marshfield*
Although there was a rail right of way between these points, it has been built on over the years, and a new right-of-way may be required. This project is not likely to generate significant demand.

Add a station on Fitchburg Line at Union Square, Somerville*
The communities along the Fitchburg Line have clearly stated the need for shorter trip times into/out of Boston. An additional station on this line would further deteriorate the quality of service by adding additional time to the current trip.

Build Greenbush branch of Old Colony rail lines

New station on Fitchburg Line near Twin City Plaza on Cambridge/Somerville Line

Add a station at Route 128/Masspike on the Framingham/Worcester line

Build a commuter rail branch to Logan Airport*
This project does not support local and regional plans. AITC would provide the same service to Logan Airport. The North Shore Major Investment Study is also looking at several connec-

tions between commuter rail and subway (Revere and Lynn) that would provide similar service. This option would also be technically infeasible.

Extend commuter rail service from Cordage Park to Plymouth Center*
This extension has significant right-of-way issues, and it appears that there is limited community support for this project.

Extend proposed Millis Line to Medway*
After the Town of Millis, there are significant right-of-way/encroachment issues along this corridor.

Institute a new commuter rail line from Lowell to New Bedford*
Given that existing transit demand has not yet warranted bus service along this circumferential corridor, it is unlikely that a new commuter rail line would attract enough riders to be cost effective. In addition, since Phases 2 and 3 of the Urban Ring have not yet been included in the Regional Transportation Plan, it is premature to consider additional circumferential transit lines that would serve less densely-developed neighborhoods.

Institute a new commuter rail line from South Acton to Marlborough*
Given that existing transit demand has not yet warranted bus service in this intersuburban corridor, it is unlikely that a commuter rail service would attract enough riders to be cost effective.

Operate EMU commuter rail trains from Hynes Convention Center to new convention center*
While this new service would provide a one-seat ride from the Seaport District to the Back Bay, it would likely operate less frequently and have a more circuitous routing than the proposed one-transfer service via the Green Line in the Back Bay and Silver Line from Boylston Station to the new Convention Center. Furthermore, the City of Boston has expressed its support for consideration of a new east-west rapid transit line from the Seaport District to the Back Bay using the Silver Line tunnel to Boylston Street and a new right of way under Stuart Street.

Bus

Better downtown bus distribution: Expand the coverage of downtown stops for bus routes serving downtown*
This concept was tested in a pilot program for bus routes operating between the North Shore and Downtown Boston. It was found that demand for extending these routes beyond their Haymarket terminal was very low, and that service reliability suffered.

Operate suburban commuter rail feeder bus services

Improve feeder bus service to Fitchburg commuter rail station*
Fixed-route local bus service in Fitchburg is the responsibility of Montachusett Area Regional Transit (MART). Proposals for routing changes should be addressed to their service planning staff.

Urban Ring: Construct a transit system following a circular route around the inner core. Phase I includes new conventional bus routes, and Phase 2 includes new bus rapid transit segments

New bus service from Framingham Exit 12 park-and-ride lot to T. F. Green Airport and Manchester Airport*
Regional express bus service to area airports is the responsibility of the Massachusetts Port Authority and other regional airport authorities. Proposals for new routes should be addressed to their ground transportation planning staffs.

Operate feeder buses to Mansfield commuter rail station*
Fixed-route local bus service in Mansfield is the responsibility of the Greater Attleboro-Taunton Regional Transit Authority (GATRA). Proposals for routing changes should be addressed to their service planning staff.

Run from Rhode Island to Fall River to connect with the proposed commuter rail line*
Fixed-route local bus service in Fall River is the responsibility of the Southeastern Regional Transit

Authority (SRTA). Fixed-route local bus service in Rhode Island is the responsibility of the Rhode Island Public Transit Authority. Proposals for routing changes should be addressed to their service planning staffs.

Run a jitney van loop from Forest Hills to Longwood Medical Area to Coolidge Corner*
Frequent bus service already operates from Forest Hills to the Longwood Medical area with convenient connections to another frequent bus route serving Coolidge Corner. Jitney van service would be redundant and operate much less frequently, resulting in very low ridership.

Extend Trackless Trolley #71 from Watertown to Newton Corner

Build a bus rapid transit line along the Saugus Branch*
Existing transit service connecting Saugus to Malden does not suggest that there would be sufficient demand for rapid transit service between these two points. Furthermore, the operation of such a line would likely result in less frequent service on existing commuter-oriented routes from Saugus to Downtown Boston and from Saugus to Wonderland Station. This idea has also not received the support of the North Shore MIS Steering Committee.

Run more express buses to Boston from Scituate, Cohassett, Norwell, Marshfield, and Hingham*
Most of the market for improved bus service in this area will be served by the new Greenbush Commuter Rail Line. Consequently, demand for this service would likely be extremely low.

Add 100 additional buses regionwide

Create HOV lanes on Route 128 and operate circumferential bus service

New busways to Alewife Station along heavily congested portions of Alewife Brook Parkway and Route 2

Build a surface busway along the Central Artery right of way*
The concept of extending express bus routes further into Downtown Boston was tested in a pilot program for routes operating between the North Shore and downtown. It was found that demand for extending these routes beyond their Haymarket terminal was very low, and that service reliability suffered. In general, the subway system is better equipped to provide efficient circulator service in Downtown Boston.

Intersuburban bus service

Operate express buses from Lowel to Hanscom area*
There is very low demand for existing bus service from the Red Line to the Hanscom area. Since the number of Hanscom area employees with convenient access to the Lowell bus terminal would be much lower than those with access to the MBTA rapid transit system, it is likely that demand for service from Lowell would be extremely low.

Boat

Build a passenger terminal at Russia Wharf (near South Station)

Operate commuter boats through Cape Cod Canal*
Commuter service to Boston from towns in the South Coast region and along Cape Cod's south shore is already provided by multiple bus companies. These existing bus services would provide much faster travel times than commuter boats traveling through the canal. Consequently, ridership would likely be extremely low.

High-speed ferry service from North Shore (Lynn/Salem) to Boston and the airport

Restore East Boston ferry

Improve ferry service from South Shore communities (Quincy, Hingham, Hull, Cohasset, and Scituate) to Boston. Improve ferry infrastructure as part of expansion

Operate ferry service to Assembly Square, Somerville*
Ferry routes from Assembly Square to downtown

Boston and the South Boston Waterfront would serve some of the same general transit markets that the new Orange Line station at Assembly Square is intended to address. Given the wider set of destinations that could be served from Assembly Square with direct Orange Line access and the substantial public support for station construction, this potential ferry improvement will not be examined in greater detail in this PMT.

Systemwide and Miscellaneous

Light rail from Route 495 to Burlington*
Most of the markets that would be served by such a line are already served by the MBTA's Lowell Commuter Rail Line. It should also be noted that feeder bus service from suburban commuter rail stations to major employment centers and residential neighborhoods will be examined as part of this PMT.

Connect Telecom City to Urban Ring with a busway*
Demand for transit service to/from Telecom City does not yet warrant local bus service, and traffic congestion is not heavy enough to require use of a dedicated right-of-way if such service was to be implemented. Suggestions for new local bus routes should be directed toward the MBTA's Service Planning Process.

Build light rail feeder lines to Framingham from Walpole, Milford, and Marlborough*
Since fixed-route bus service has not even been implemented between these towns, the consideration of light rail feeder service to the Framingham/Worcester Commuter Rail line is premature.

Add an outer Urban-Ring from Harvard Square to Dudley via Allston and Brookline (Route 66 routing) or from Roxbury Crossing to Wellington via Coolidge Corner, Harvard, and Davis Stations*
Since Phases 2 and 3 of the Urban Ring have not yet been included in the Regional Transportation Plan, it is premature to consider additional urban circumferential rapid transit lines that would serve less densely-developed neighborhoods.

Build light rail line from South Acton Station to Maynard Center*
This corridor is served by an existing shuttle bus route. Since initial observations of ridership on this route indicate very limited cost effectiveness, it is unlikely that adequate demand exists for a rail rapid transit line.

Build light rail line in South Boston to replace #9 bus*
Existing plans call for both the Silver Line and the Urban Ring to serve markets along the Bus Route 9 corridor. Furthermore, the negative impact of a light rail line on traffic flow and parking along Broadway would be substantial. It is also unclear that the line would provide travel time savings or frequency improvements over existing bus service.

Monorails and Bullet Trains

North Station-South Station monorail*
Since existing rapid transit lines are well designed to provide circulator service in downtown Boston for commuter rail passengers, and since the Orange Line provides service between North Station and Back Bay Station for intercity passengers, a monorail along the Central Artery right-of-way would likely attract very few riders.

Build a monorail system on a circumferential route along the I-495 right-of-way*
Given that existing transit demand has not yet warranted bus service along this circumferential corridor, it is unlikely that a monorail service would attract enough riders to be cost effective.

Build monorail along Saugus Branch railroad*
Commuter service along the Saugus Branch right-of-way would be more efficiently provided by conventional commuter rail equipment than a monorail. Conventional trains would be compatible with vehicles used on other suburban commuter lines and could operate in a potential North-South Station Rail Link. Monorail trains would also not provide substantially faster service than conventional trains.

Build monorail along Route 3 north right-of-way*
Most of the markets that would be served by such a monorail line are already served by the MBTA's Lowell Commuter Rail Line. It should also be noted that feeder bus service from suburban commuter rail stations to major employment centers and residential neighborhoods will be examined as part of this PMT.

Non-Motorized Modes

Build bikeways next to commuter rail lines*
While the MBTA is willing to work with other transportation agencies to facilitate capital improvement projects that encourage non-motorized transportation as an access mode to transit services, the MBTA is not responsible for funding or constructing roadways for non-transit vehicles. Furthermore, any new roadways on MBTA commuter rail rights of way must be built with the provision that they could be closed in the future for the purpose of expanding commuter rail capacity.

Build bikeway from Alewife to Waltham Center*
While the MBTA is willing to work with other transportation agencies to facilitate capital improvement projects that encourage non-motorized transportation as an access mode to transit services, the MBTA is not responsible for funding or constructing roadways for non-transit vehicles. Furthermore, any new roadways on MBTA commuter rail rights of way must be built with the provision that they could be closed in the future for the purpose of expanding commuter rail capacity.

Extend bikepath from Somerville to Lechmere*
While the MBTA is willing to work with other transportation agencies to facilitate capital improvement projects that encourage non-motorized transportation as an access mode to transit services, the MBTA is not responsible for funding or constructing roadways for non-transit vehicles. Furthermore, any new roadways on MBTA commuter rail rights of way must be built with the provision that they could be closed in the future for the purpose of expanding commuter rail capacity.

SERVICE ENHANCEMENT AND SYSTEM PRESERVATION PROJECTS

Blue Line

Signal and train control improvements

Maintain access to Blue Line from Bowdoin Station*
The existing Bowdoin Station platform is of a center island design and is built into the Blue Line's loop terminus. Trains begin reversing direction on this loop while inside the station and complete their turn just to the west of the station. Because of this design, the lengthening of the platform to six car lengths would result in unsafe gaps between the platform and the train. Furthermore, new station entrances being built at Government Center Station will provide Blue Line access very close to existing Bowdoin Station entrances. For these reasons, keeping Bowdoin Station open permanently would be both prohibitively technically complex and would serve very few customers.

Install an escalator to the inbound platform at Airport Station

Operate six-car trains

Orange Line

Rebuild and operate third track from Medford to Charlestown*
Operation of express trains on a separate track between Wellington Station and North Station would avoid stops at only Sullivan Square and Community College Stations, thereby not saving substantial running time. It would also inconvenience the large number of people boarding/alighting from trains at Sullivan Square Station, especially during peak periods when some existing trips already operate at near maximum capacity.

Signal replacement, Haymarket to Oak Grove

Operate eight-car trains

Red Line

Signal and train control improvements

Update Mattapan-Ashmont line to full light-rail standards

Replace 74 Red Line #1 cars built in 1969

Flood prevention for Wollaston Station fare collection area

Operate eight-car trains

Green Line

Signal and train control improvements

Preemptive signals on Beacon, Commonwealth, and Huntington

Relocate Lechmere Station to the other side of Msgr. O'Brien Highway

Build third Green Line track between Park Street and Kenmore to allow for express trains* *The technical complexity of this proposed project is extremely high given that a third track could not be accommodated within the confines of the existing right of way. Expansion of the right of way would impact numerous large buildings and result in significant disruptions of business there. Instead, expansion of subway capacity in this corridor will be explored by means of constructing a new parallel subway along Saint James Avenue.*

Build a by-pass tunnel from Kenmore to Park St. under the Commonwealth Avenue Mall* *While this project is technically feasible, it was reviewed in the 1994 PMT where it was not recommended. Furthermore, recent planning studies by the City of Boston give preference to a Saint James Avenue alignment for expanding subway capacity in the Back Bay's east–west corridor. That alternative will be reviewed in greater detail in this PMT.*

Provide accessibility at locations not covered by "Key Station" plan. Stations and stops include: (Subway) Boylston, Hynes Convention Center/ICA, Prudential, Symphony; (Highland Branch) Beaconsfield, Brookline Hills, Chestnut Hill, Eliot, Longwood, Newton Highlands, Waban, Woodland; (Huntington and South Huntington Avenues) Back of the Hill, Fenwood Road, Mission Park, Riverway; (Beacon Street) Brandon Hall, Dean Road, Englewood Avenue, Fairbanks Street, Hawes Street, Kent Street, St. Paul Street, Summit Avenue, Tappan Street; (Commonwealth Avenue) Allston Street, Babcock Street, Blandford Street, BU West, Chestnut Hill Avenue, Chiswick Road, Fordham Road, Greycliff Road, Griggs Street, Mt. Hood Road, Packards Corner, Pleasant Street, South Street, St. Paul Street, Summit Avenue, Sutherland Road, Warren Street; (Mattapan-Ashmont) Butler, Capen Street, Cedar Grove, Central Avenue, Milton, Valley Road.

Flood prevention for Fenway portal

Operate four-car trains

Silver Line

Construct Commonwealth Flats grade-separation project

Commuter Rail

Install double-tracking on entire commuter rail system

Install a fourth track on the Fort Point Channel Bridge

Install welded rail along sections of Haverhill, Lowell, and Fitchburg lines not presently equipped with it

Flood prevention at Natick Station and on Fitchburg Line near Boston Engine Terminal

Rebuild Fitchburg layover facility

Construct high platforms at all Providence Line stations not so equipped and expand to other lines at later date

Improve Rockport Station facility

Improve Lawrence Station facility

Keep Mishawum Station open as a full-time

facility*
Before the opening of the Anderson Regional Transportation Center, most customers accessed Mishawum Station by automobile and traveled in a traditional commuting pattern (inbound during the morning and outbound during the evening). These customers are now fully accommodated at the Anderson Regional Transportation Center, which provides more parking spaces and improved waiting facilities. Those customers who were not fully accommodated by the new station were generally reverse commuters who worked at businesses located within walking distance of Mishawum Station. These commuters are now served by the limited reverse direction peak period service being provided there. As a result, reopening Mishawum Station for peak direction trains during the peak period would attract very few new customers, but would inconvenience many with longer commuter rail travel times.

Improve pedestrian access to Anderson RTC from western side of tracks

Make necessary track improvements and purchase additional equipment required to operate express service

Operate express service from outer stations

Operate a Yawkey-Back Bay-South Station shuttle

Expand parking at Fitchburg Station

Operate more frequent peak period service between Framingham and Worcester

Build new layover facility near Worcester Station

Build new layover facility in Bellingham for Franklin Line

Electrification of commuter rail lines

Hourly service on commuter rail during weekday evenings

Add bike racks to coaches

Renovate Wedgemere Station and charge for parking

Increase the size of the waiting area at North Station

Rebuild West Medford Station

Install additional platforms at Forest Hills Station so all trains coming from Hyde Park Station can stop there without switching tracks*
Since the rapid transit and commuter rail tracks at Forest Hills Station are built in an open cut below ground level, it would be necessary to excavate additional land in order to build a new commuter rail platform. While this is technically feasible, it presents a major barrier when considering the potential cost effectiveness of the project. Furthermore, the demand for commuter rail service at Forest Hills station is quite low given that Orange Line service is also available there. This demand is adequately served by the frequency of trips provided on the Needham Line, and existing passengers on other lines would likely be opposed to making an additional stop at Forest Hills.

Install platforms on both sides of tracks at stations in Newton along the Worcester Line so that more trains in both directions can stop at these stations.

Expand capacity of South Station

Expand capacity of North Station

Upgrade Yawkey Station

Place bicycle racks on commuter rail locomotives*
Since many commuter rail stops utilize high level platforms, it would not be feasible for passengers to reach the fronts of locomotives and secure bicycles there. Furthermore, at stations with low-level platforms, passengers are not permitted to walk on the tracks except at designated crosswalks. Consequently, they would not be able to secure bicycles on the fronts of locomotives at these stations either.

Purchase diesel multiple unit trains to allow for

increased frequency on commuter rail lines

Build new sidings at selected commuter rail stops to reduce delays for Acela trains*
While the MBTA would be willing to help facilitate capital improvements that would reduce delays on Acela trains in the commuter rail service area, it would not be the MBTA's responsibility to fund such projects. Since MBTA customers would not benefit from such improvements, it will not be considered in greater detail as part of the PMT.

Install quadrant gates at all commuter rail grade crossings in Gloucester*
Adequate evidence which shows the ability of quadrant gates to improve safety does not exist. Communities may currently petition the Legislature for legislation to eliminate train whistling at locations within their community. The addition of quadrant gates at specific locations would not in and of itself allow the MBTA to discontinue its practice of "whistle blowing". The MBTA firmly believes that whistle blowing at grade crossings is a key part of the warning system. Whistling provides an increased measure of safety and no other measure, short of crossing elimination, has proven an effective replacement.

Refurbish single-level commuter rail coaches as cafes and health clubs*
Since the length of most commuter rail trips is relatively short and stops are closely spaced, it is not practical to offer cafes and health clubs on board trains. Among other issues, conductors would find it more difficult to collect fares if customers were walking from car to car throughout the trip. More importantly though, since the number of cars on each train is limited by station platform lengths, new cafe or health club cars would have to take the place of passenger coaches. This could result in a less cost effective service and/or additional crowding which would generate opposition in the communities served.

Provide accessibility at stations not covered by "Key Station" plan. Stations include: Auburndale, Ayer, Belmont, Chelsea, Concord, Endicott, Franklin, Greenwood, Hastings, Islington, Kendal Green, Lincoln, Littleton, Melrose, Melrose Highlands, Morton Street, Natick, Newtonville, North Leominster, North Wilmington, Plimptonville, Prides Crossing, Riverworks, Rockport, Sharon, Shirley, Silver Hill, South Acton, Uphams Corner, Wakefield, Walpole, Waltham, Waverley, Wedgemere, Wellesley Farms, Wellesley Hills, Wellesley Square, West Medford, West Newton, Winchester, Windsor Gardens, Wyoming Hill

Replace 164 single-level cars built in 1979 and 1987 with 100 new bilevel cars

Replace 18 locomotives built in 1978 and 1980

Fairmount Line: Bridge replacement work

Build new layover facility in North Andover to replace Haverhill (Bradford) facility

Bus

Install 300 new shelters

Install automatic passenger counters on buses

Upgrade destination signs and install automatic stop announcement equipment on 1989, 1994, and 1995 buses

Install Intelligent Transportation System (ITS) systems for bus fleet (signal prioritization, Automatic Vehicle Locator (AVL), passenger information kiosks)

Build new park-and-ride lots along existing express bus routes

Improve bus stop signage

Provide State Police escorts through heavy traffic for express buses*
While State Police escorts could facilitate slightly faster travel times for MBTA buses, this practice would be inconsistent with regional transportation plan policies to improve air quality by easing congestion on area roadways. State Police escorts would further disrupt traffic flow on already congested expressway segments.

Convert diesel bus routes in Cambridge (1, 74,

and 77) to trackless trolley*
While the MBTA is committed to continued operation of existing trackless trolley lines in Cambridge, Watertown, and Belmont, local plans in these municipalities – and in Arlington where the northern terminus of Route 77 is located – do not call for the conversion of other diesel bus routes to trackless trolleys. Such conversions would make it more difficult for vehicles to divert around construction areas or traffic accidents, and for the MBTA Service Planning Department to make long-term routing adjustments based on passenger demand and mobility needs.

Convert Route 57 (Watertown-Kenmore) to trackless trolley*
While the MBTA is committed to continued operation of existing trackless trolley lines in Cambridge, Watertown, and Belmont, local plans in these municipalities – and in Boston where the eastern terminus of Route 57 is located – do not call for the conversion of other diesel bus routes to trackless trolleys. Such conversions would make it more difficult for vehicles to divert around construction areas or traffic accidents, and for the MBTA Service Planning Department to make long-term routing adjustments based on passenger demand and mobility needs.

Add exclusive lanes and priority signals along the top ten highest ridership bus routes

Install new dispatch and communications systems

Replace 600 diesel buses built in 1989, 1994, and 1995

Construct a new bus maintenance/garaging facility

Systemwide and Miscellaneous

Expansion of park-and-ride lots beyond the 20,000-spaces commitment that was fulfilled

Provide increased security at power stations*
Increased patrols of any MBTA facility is primarily an issue of personnel allocation for the MBTA Police Department. It is not clear that there are any capital expenditures associated with power facility safety improvements that should be examined in detail as part of the PMT.

Improve designs of transportation facilities*
Aesthetic features of MBTA stations are often upgraded as part of larger capital improvement projects. However, since aesthetic improvements alone do not necessarily attract additional riders, they will not be considered in greater detail as part of the PMT.

Add more bike and motorcycle parking spaces systemwide

Construct a pedestrian passageway from Back Bay Station to Copley Square*
While it would be technically feasible to construct a pedestrian tunnel from Copley Station to Back Bay Station, deep-bore tunneling methods would be necessary to pass underneath the Massachusetts Turnpike right of way. Given that this tunnel would not result in any improvement in the pedestrian transfer time between the two stations, the number of new passengers attracted would be extremely low. However, it should be noted that new automatic fare collection equipment being purchased by the MBTA could allow for free transfers between the station entrances, even though passengers would be obliged to walk via surface sidewalks.

More enclosed waiting areas

Have signs in multiple languages

Have unmanned turnstiles at entrances closed in the past due to lack of staffing

Provide walkways between inbound and outbound sides at stations which do not have them (Boylston, Copley, Symphony, Chinatown, Kendall, and Central)*
While new walkways between inbound and outbound platforms would benefit the occasional traveler, they would not result in an improvement in station walk access times for regular customers. New walkways of this type have also not been a priority of any local municipalities in their advocacy efforts to the MBTA. Consequently, the cost effec-

tiveness of this improvement would likely be prohibitively low. However, it should be noted that new automatic fare collection equipment being purchased by the MBTA could allow for free transfers between the station entrances, even though passengers would be obliged to walk via surface sidewalks.

Provide spaces for short term rental car parking at rapid transit stations

Implement automated system to inform passengers about delays on their regularly traveled routes using pagers, cell phones, and E-mail

Build future rapid transit cars to provide windows at both the front and rear of cars*
While some passengers may desire the ability to look out the front and back of trains while traveling on rapid transit lines, the installation of such windows would prevent operators and door attendants from being able to look out both sides of the train without having to leave their cabs.

Implement radio-based train control systems to replace block signaling systems on rapid transit lines

Install new equipment to enhance the security of passengers at MBTA stations and on board vehicles

Monorails and Bullet Trains

Operate high-speed rail equipment on commuter rail lines*
The operation of high-speed rail equipment would not be practical for operation on most commuter rail lines, and the resulting travel time improvements would be too small to attract a substantial number of new passengers. Since the stop spacing on commuter rail lines is so short, high-speed rail equipment would not be able to attain travel speeds that are substantially faster than those of existing conventional commuter rail locomotives.

Non–Motorized Modes

Improve bicycle and pedestrian access to rapid transit and commuter rail stations

More bike parking at MBTA stations (consider bike valets)

Provide automated bike rental machines at selected rail stations*
The MBTA would consider leasing space to bicycle rental enterprises at most of its rail stations. However, this project would not qualify as a MBTA capital expenditure, and thus will not be examined in greater detail in the PMT.

PROJECTS TO BE CONSIDERED IN THE MBTA SERVICE PLANNING PROCESS

Blue Line

Operate shorter trains with higher frequency

Orange Line

Operate shorter trains with higher frequency

Red Line

Operate shorter trains with higher frequency

Green Line

Operate B Line trains through to North Station

Commuter Rail

Operate late service Friday and Saturday

Operate all Plymouth/Kingston Line trains to Kingston

Increase service frequency on Haverhill/Reading Line

Increase speed and frequency of Needham service

Bus

New express bus routes, Burlington-Boston and Burlington-Alewife, which would serve new park-and-ride facilities

Express buses from Lowell to Hanscom area

Add limited-stop bus routes

Express service from Reservoir to Copley/Downtown via Commonwealth Avenue and Masspike

Operate express service from Mattapan to South Station via Blue Hill Avenue, Hampden Street, and Route 93

Extend the CT1 bus line from Central Square to Arlington Heights

Operate an 'outer ring' bus line from Alewife to Logan Airport via Arlington Center and Medford Square

Operate an 'outer ring' bus line from Roxbury Crossing to Wellington via Coolidge Corner, Harvard, and Davis Stations

Evaluate the benefits of moving all bus stops located at street intersections to the 'far sides' of those intersections

Boat

Operate new ferry route from Lovejoy Wharf to Russia Wharf

Systemwide and Miscellaneous

Improve access to suburban employment districts

Operate 24-hour service

Operate 10-minute-or-better frequencies at all times (including evenings and Sundays) on rapid transit system and busiest bus routes

APPENDIX F

Ridership Forecasting

INTRODUCTION

The travel model set that was used for the Program for Mass Transportation (PMT) is based on procedures and data that have evolved over many years at the Central Transportation Planning Staff (CTPS). This report describes the basic attributes of the model set, how it was applied for the PMT.

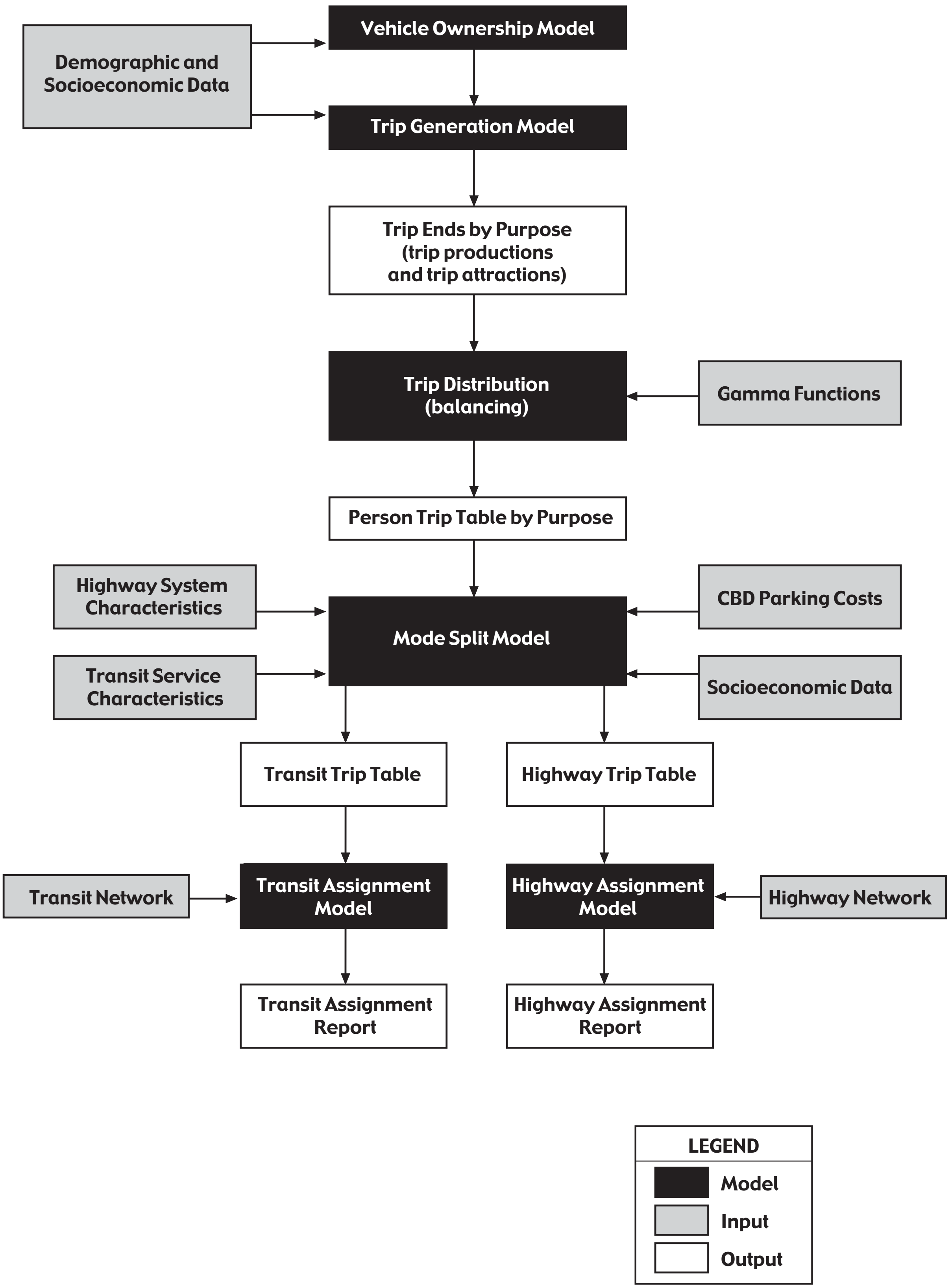
The following section presents an overview of the travel model used in this study and describes each major step in the travel model process including the calibration procedure. Section 3 describes how the calibrated model was applied to various PMT analyses.

CTPS TRAVEL MODEL

General Description of the Model

The travel model used for the PMT study is more sophisticated and versatile than the any other travel model developed by CTPS. It is based on the traditional four-step urban transportation planning process of trip generation, trip distribution, mode choice, and trip assignment. This process is used to estimate the daily transit ridership and highway traffic volumes, primarily on the basis of forecasts of study area demography and projected highway and transit improvements. The model set simulates travel on the entire Eastern Massachusetts transit and highway system. As such, it contains all MBTA rail and bus lines and all private express bus carriers. The model contains service frequency (i.e. how often trains and buses arrive at any given transit stop), routing, travel time and fares for all these lines. In the highway system, all express highways and principle arterial roadways and many minor arterial and local roadways are included. Results from the computer model provide us with detailed information relating to transit ridership demand. Estimates of passenger boardings on all the existing and proposed transit lines can be obtained from the model output. A schematic representation of the modeling process is shown in Figure 1.

FIGURE F-1 FOUR STEP TRANSPORTATION PLANNING PROCESS



In the first step, the total number of trips generated by the residents of the Eastern Massachusetts area is calculated using demographic and socio-economic data. Similarly, the number of trips generated by different types of land use such as employment centers, schools, hospitals, shopping centers etc., are estimated using land use data and trip generation rates obtained from travel surveys. This information is produced at highly disaggregated geographic areas known as traffic analysis zones (TAZ). All calculations are performed at the TAZ level.

In the second step, the model determines how the trips generated would be distributed throughout the region. Trips are distributed based on transit and highway travel times between TAZs and the relative attractiveness of each TAZ which is influenced by the number of jobs available, size of schools, hospitals, shopping centers etc.

Once the total number of trips between all combinations of TAZs is determined, the mode choice step of the model divides the total trips among the available modes of travel. In our case, the available modes of travel are walk, auto and transit. To determine the proportions of each mode, the model takes into account the travel times, number of transfers required, and costs associated with these options. Other variables such as the auto ownership and household size are also included in the model.

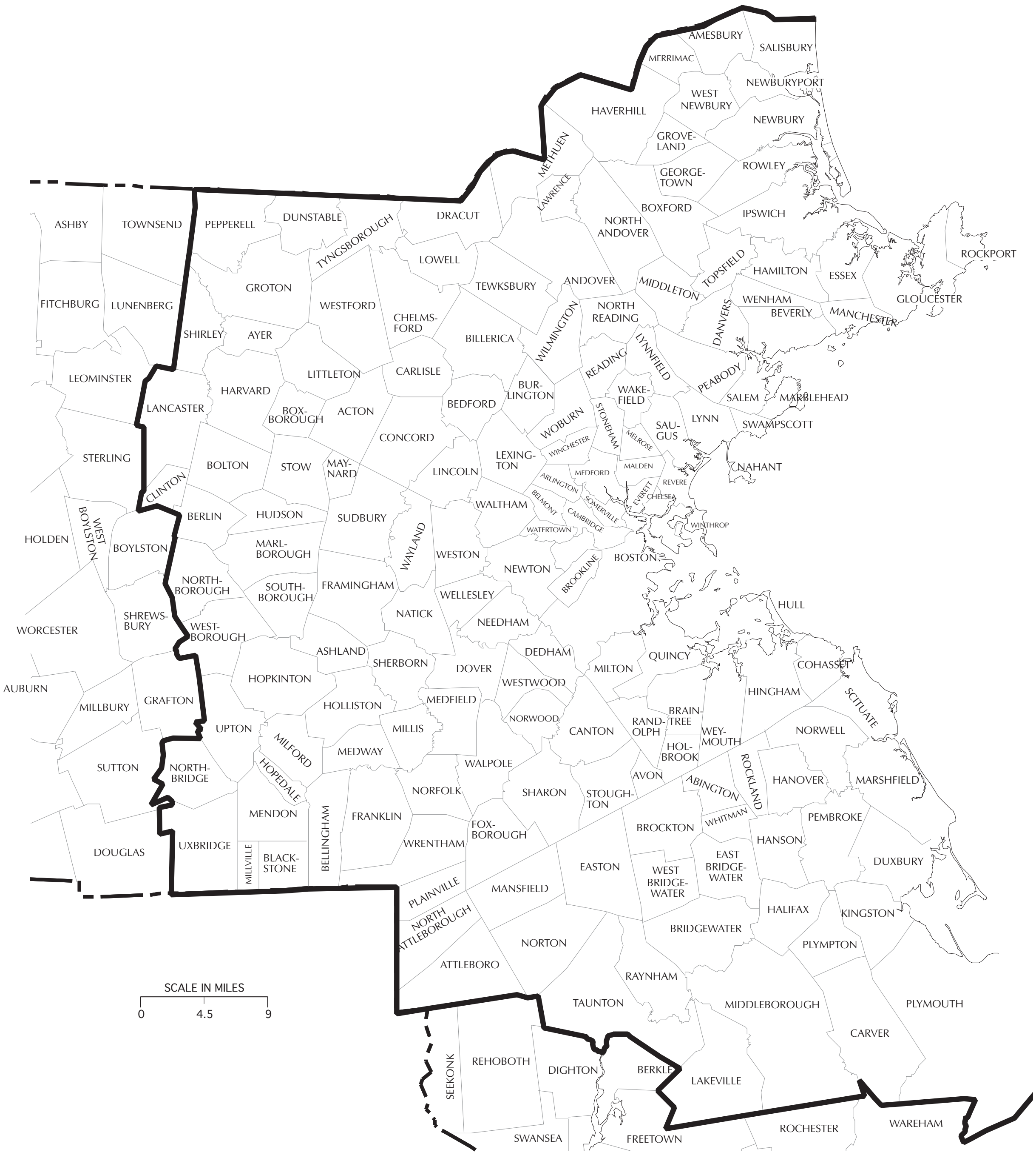
After estimating the number of transit and auto trips for all possible TAZ combinations, the model assigns them to their respective transportation networks (this is the fourth and final step). Various reports showing the transit ridership on different modes and traffic volumes on the highway network can be produced according to our needs.

The model set uses the best component models, networks and input data available to CTPS at this time, and contains enhancements rendered specifically for each project included in the PMT study. The following is a list of some of the enhancements incorporated in the model.

- The model is set up to simulate passenger and highway travel during AM and PM peaks of a typical weekday.
- The model set incorporates motorized and non-motorized trips.
- EMME/2 software used in implementing the model is capable of performing multi-class, multi-path assignment that is superior to the traditional all-or-nothing assignment.
- The model set recognizes the parking lot capacity constraints indirectly when assigning park and ride trips.
- The transit assignment procedure can be constrained to a given line capacity.
- The park and ride trips can be reassigned to the highway network for a more realistic highway assignment.
- The procedure that estimates air quality benefits is more sophisticated and well integrated within the main model.
- The trip generation and distribution portions of the model set are better calibrated than the previous versions.

In addition, the model set was calibrated with the specific needs of this project in mind. That is, transfer behavior, cross-town travel, study area transit line boardings and other relevant items were calibrated particularly well. Since this study focuses mainly on transit alternatives, more emphasis was placed in calibrating the transit component of the model. The highway component of the model was calibrated such that the simulated traffic volumes on the area's major highways and arterials matched the observed count data within 15 percent. The base data on which the models were calibrated are for year 2003.

FIGURE F-2 EASTERN MASSACHUSETTS MODELED AREA



Modeled Area and Zone System

The modeled area encompasses 164 cities and towns in Eastern Massachusetts, as shown in Figure 2. The figure also shows the boundaries of five concentric rings into which the modeled area is divided for model estimation and calibration purposes. These rings will be referred to in subsequent discussions. The modeled area is divided into 986 internal Traffic Analysis Zones (TAZs). There are 101 external stations around the periphery of the modeled area that allow for travel between the modeled area and adjacent areas of Massachusetts, New Hampshire and Rhode Island. The 986 internal zone system was created by completely revamping the 787-zone system through zonal disaggregation. The disaggregation process was conducted such that the boundaries of the disaggregated zones respected the U.S. Census Tracts. This enabled us to use the 1990 Census data (at the tract level) to prepare some of the base year model inputs.

Major Data Inputs

CTPS's travel model set underwent a major revision in 1993, and several important data sources were used in that revision. The model set was improved still further for the PMT analysis, and more data were collected for that purpose. This section lists the major data items underlying the model set. These items will be cited or discussed elsewhere in this report, but they are listed together here for convenience.

Data Items Used in the 1993 Revision

Household Travel Survey: In 1991, CTPS conducted a household travel survey. The survey took the form of an activity-based travel diary that was filled out for one weekday. Approximately 4,000 households, generating some 39,000 weekday trips were represented in the final database. The data were used to estimate new trip generation, auto ownership distribution and mode choice models.

External Cordon Survey: Also in 1991, a survey of automobile travelers bound for the modeled area from adjacent areas was performed. Survey results were used in trip generation and distribution to update estimates of external trips.

Site-level Employment Database: Employment estimates for 1991 were taken from state-provided sources and a commercial vendor's database purchased by CTPS, and combined into a single, unified regional employment database.

1990 U.S. Census: Various files were used in model estimation and calibration processes.

Ground Counts: Transit ridership and highway traffic volume data representing early 1990's conditions were amassed into a database and used to calibrate the travel models.

While the model set is based primarily on the data items cited above, additional data were collected in 1996 and 1997 in order to refine and improve the models still further for the PMT analysis. Floor space by type for 1996 was collected from assessors in the ten communities in the study area. The planning and development departments of those communities provided 2025 forecasts of land use by type as well. As discussed later, these land use data were transformed into estimates of households and employment and used in trip generation.

Transportation Networks

The regional highway and transit networks are integrated and are contained in EMME/2.

Highway

The regional highway network contains in excess of 40,000 links and 15,000 nodes. It is fairly dense in the study area, although like any modeled network, it does not include some local and collector streets. Speed and capacity classes are not used. Each link is coded with the appropriate free-flow speed, number of lanes and lane capacity. Functional class is coded, as are various geographic flags useful for

summarizing emissions. Another code is used to distinguish links open only to High-Occupancy Vehicles (HOV) from all other links.

Transit

The transit network represents all MBTA bus and rail services in Eastern Massachusetts, as well as private express buses and Boston Harbor ferries. Most-likely travel paths are built through the network, then skimmed and the resulting impedances are input to the trip distribution and mode choice models. After mode choice, transit trip tables by time of day are assigned to the network travel paths.

Network Building Conventions

Transit Links and Lines

Bus lines are overlaid on highway links and rail links are coded separately. Bus speeds can be made a function of highway travel speeds. However, for the PMT analysis, no such function was used. Instead, future-year bus speeds were estimated on the basis of future-year congested highway speeds. In some instances, where special busways were assumed in certain alternatives, bus speeds were determined on the basis of the level-of-service data provided by the client and their consultants.

Walk-access Links

Walk-access times coded onto walk links represent the average walk time from all points in a zone to the transit node. These times were initially measured using the Arc/Info Geographic Information System (GIS) and then input to the EMME/2 transit network. Walking speed was assumed to be three miles per hour. The maximum walking distance for a bus is coded as one-fourth of a mile while it is one-half to three-quarters of a mile for rapid transit and commuter rail.

Drive-access Links

Each TAZ beyond the Boston core area is connected to the four closest park-and-ride nodes with drive-access links. Appropriate drive time and distance values were obtained from the highway network and coded onto these links. Each park-and-ride node is connected to its associated transit node with a short walk link. In the Boston core, no drive-access links are provided. The parking lot fare is coded directly on the link connecting the park-and-ride node to the station node.

Transfer Links

Transfer links are provided in the network where appropriate. For all downtown and some other rail stations, actual walking times from line to line were recently measured in another CTPS project, and these values are coded onto the transfer links.

Walk Network

A walk network covers downtown Boston and serves as a circulator system between TAZs and transit stations/stops. In the CBD, travelers often alight the line-haul line and then walk several blocks to their final destinations instead of transferring downtown from one line to another and riding one more station before alighting. Prior to the introduction of the walk network, when each TAZ was directly connected to one or more stations, the pathbuilder usually found a path involving a transfer; hence, downtown transferring was overestimated.

With the walk network, the pathbuilder finds more accurate paths. Each station and each TAZ is connected to the walk network, which then acts as a distribution system for the walk portion of downtown transit trips. The walk speed on the walk network is coded as three miles per hour. Each downtown TAZ is connected to a node on the network with a distance of 0.1 mile. TAZs on the periphery of the walk network are connected using the actual distance involved. Links connecting transit stations to the walk network are coded either with observed walk time, if available, or a distance of 0.1 mile.

Fare Coding Conventions

Fares were coded in the EMME/2 network at the appropriate transit nodes. Adult cash fares were used. Each mode is assigned a boarding fare and up to seven fare link codes. Because of the complexity of the area's fare system, not all private express bus, Green Line and Red Line Braintree branch fares are represented exactly as is, but are represented reasonably well. Park-and-ride parking charges are coded onto the walk link that connects the park-and-ride node to the transit station node. The matrix in Table 1 summarizes the fare policy used in this study. The fares shown are in year 2000 cents. The fare assumptions for all of the new stations are consistent with the existing MBTA fare policy.

Path Building Conventions

The transit assignment implemented in EMME/2 is a multipath assignment, based on the computation of optimal strategies. The optimal strategy is one that minimizes the total expected perceived travel time. The values shown in Table 2 are currently being used in estimating the perceived travel times between a given origin and a destination. These values apply both to walk-access transit and drive-access transit and to all submodes. They relate to in-vehicle time. For example, a transfer wait time factor of 2.45 implies that travelers perceive a minute of such time as 2.45 times more onerous than a minute spent riding in a transit vehicle. Although these values are theoretically supposed to correspond to marginal rates of substitution implicit in mode choice model coefficients, their final values are partly based on what is needed to force the pathbuilder to find what are deemed reasonable paths through the network.

Household and Employment Forecasts

Households and employment by type are the major input into the travel model process: they are the variables upon which trip generation is done. The forecasts of households and employ-

TABLE F–1
Matrix of Fares

	To									
From	**CRR**	**RT(t)**	**RT(g)**	**LRT(t)**	**LRT(g)**	**BT(t)**	**BT(g)**	**XB**	**LB**	**Boarding**
CRR	NA	100	100	100	100	100	100	Z	75	Z
RT(t)	Z	F	F	F	F	F	F	Z	75	100
RT(g)	Z	F	F	F	F	F	F	Z	75	100
LRT(t)	Z	F	F	F	F	F	F	Z	75	100
LRT(g)	Z	F	F	F	F	F	F	Z	75	100
BT(t)	Z	F	F	F	F	F	F	Z	75	100
BT(g)	Z	F	F	F	F	F	F	Z	75	100
XB	Z	100	100	100	100	F	F	Z	100	Current premium fare
LB	Z	100	100	100	100	30*	30*	Z	100	75

F Free Transfer
CRR: Commuter Rail
RT(t): Rapid transit in tunnel
RT(g): Rapid transit at grade
LRT(t): Light Rail Transit in tunnel
LRT(g): Light Rail Transit at grade
XB Express Bus
LB: Local Bus
Z: Zone fare
*** A transfer fee of 30 cents assessed if LB enters BT**

TABLE F-2
Current Pathbuilding Parameter

Parameter	Value
Initial wait time factor	1.1
Transfer wait time factor	2.45
Drive-access time factor	2.65
Walk-access time factor	1.6
Walk speed	3.0 mph
Maximum transfers	5.0
Maximum/minimum initial/ transfer wait times	20 min.
Fare factor	1.0

ment for this region were developed by MAPC using what is called "Targeted Growth" method. In this method, growth is targeted to denser areas with available water and sewer infrastructure with a focus on development around transit stations. As indicated in Table 3, regional population, households, and employment are forecasted to grow by 16%, 25%, and 31% respectively between 1995 and 2025. The growth is expected to be greatest in the center of the region (Downtown Boston).

Auto Ownership Model

Household auto ownership is an input to trip generation and mode choice. It is forecast using a logit model developed with the 1991 Household Travel Survey and 1990 U.S. Census data. The model is integrated with the trip production procedures described in the next section. The model forecasts the number of autos available to a household-by-household income class. The independent variables are household size, workers per household, zonal population density, zonal employment density, and zonal percent transit utilization.

Trip Generation Model

The current trip generation model includes both motorized and non-motorized trips. Trip generation is done separately for internal and external trips. Furthermore, internal trips are generated differently in different parts of the modeled area.

In all cases, trips are ultimately generated for the following five purposes.

- Home-based work
- Home-based shopping, social, recreational, and other
- Home-based school
- Non-home-based work
- Non-home-based other

Internal Trips

Internal trips are trips with both ends in the modeled area. In past studies, all internal trips were generated using one set of equations for all of the modeled area. For the PMT analysis, however, two different procedures were employed for trip attractions and non-home-based productions and attractions: one for rings Zero and One, and another for rings Two through Four.

Trip Productions

A set of cross-classification models, developed on the basis of the 1991 Household Travel Survey, were for home-based trip productions. The trip generation rates (productions per household on an average weekday) vary according to household size and the location of the household within the modeled area. The number of workers per household is another variable used for home-based work trips, and the number of vehicles per household is another variable used to generate home-based non-work trips. Table 5 shows average home-based trip production rates by purpose and ring. These production rates were used everywhere in the modeled area for the study.

On average, a household in the region generates 5.56 home-based trip productions, of which 1.89 are for work trips. The rate is low-

TABLE F-3
Households and Employment Forecasts

Socioeconomic Characteristic	1995	2025	% Growth 1995–2025
Households	1,544,100	1,927,374	24.8
Ring 0	86,400	115,453	33.6
Ring 1	288,000	339,797	18
Ring 2	289,400	338,453	17
Ring 3	443,900	549,313	23.7
Ring 4	436,400	584,358	33.9
Total Employment	2,133,900	2,799,729	31.2
Ring 0	432,700	588,522	36
Ring 1	285,900	378,373	32.3
Ring 2	341,900	439,008	28.4
Ring 3	628,300	806,778	28.4
Ring 4	445,100	587,048	31.9
Basic Employment	673,400	646,010	-4.1
Ring 0	82,900	80,034	-3.5
Ring 1	59,200	65,516	10.7
Ring 2	105,000	86,038	-18.1
Ring 3	232,900	225,449	-3.2
Ring 4	193,400	188,973	-2.3
Retail Employment	295,800	448,802	51.7
Ring 0	36,000	50,736	41
Ring 1	36,200	48,843	34.9
Ring 2	46,500	63,698	37
Ring 3	107,200	159,241	48.5
Ring 4	69,900	126,284	80.6
Service Employment	1,164,700	1,704,917	46.4
Ring 0	313,800	457,752	45.9
Ring 1	190,500	264,014	38.6
Ring 2	190,400	289,272	52
Ring 3	288,300	422,088	46.4
Ring 4	181,800	271,791	49.5

TABLE F-4
Household Forecasts by Market Segmentation

	1995	2025 No-build	Growth 1995-NB
Households by HH Size	1,544,114	1,927,374	24.8%
1 person	401,904	626,274	55.8%
2 people	471,997	532,896	12.9%
3 people	269,885	333,744	23.7%
4 people	236,647	260,278	10.0%
5+ people	163,681	174,182	6.4%
Avg. HH Size	2.604	2.508	-3.7%
Population	4,160,082	4,834,012	16.2%
Households by HH Income	1,544,114	1,927,399	24.8%
< $20,000	371,217	458,131	23.4%
$20-40,000	397,738	492,063	23.7%
$40-60,000	335,194	419,324	25.1%
> $60,000	439,965	557,881	26.8%
Households by Workers/HH	1,544,115	1,927,392	24.8%
0 workers	356,591	552,072	54.8%
1 worker	531,174	690,187	29.9%
2 workers	490,800	520,730	6.1%
3+ workers	165,550	164,403	-0.7%
Avg. Work/HH	1.374	1.240	-9.7%
Total Workers	2,121,591	2,390,152	12.7%
Households by Vehicles/HH	1,544,114	1,927,117	24.8%
0 vehicles	230,060	369,077	60.4%
1 vehicle	551,597	732,054	32.7%
2 vehicles	550,212	579,988	5.4%
3+ vehicles	212,245	245,998	15.9%
Avg. Veh/HH	1.51	1.39	-7.9%
Total Vehicles	2,331,612	2,679,223	14.9%

TABLE F-5
Average Motorized Trip Production Rates

Trip Purpose	Ring 0	Ring 1	Ring 2	Ring 3	Ring 4	Region
HB work	1.36	1.65	1.88	2.19	1.88	1.89
HB shop & personal business	1.16	1.50	2.20	2.64	2.32	2.16
HB social & recreational	0.52	0.81	0.99	1.25	1.12	1.04
HB school	0.41	0.52	0.48	0.48	0.42	0.47
TOTAL	3.45	4.48	5.55	6.56	5.74	5.56

est for households in Ring Zero (Boston Proper) because many trips are being made on foot, and the rate is lower for Ring Four than for Ring Three because more external trips are being made in the former.

Trip productions at college dormitories were estimated based on dormitory populations obtained from the 1990 STF-3A census table. Modifying the cross-classification trip production rates derived trip production rates for dormitory residents. The resulting values are 0.75 for home-based work, 0.59 (rings 0 through 2) and 1.39 (Ring 3 and 4) for home-based shop and personal business, and 0.37 (rings 0 through 2) and 0.36 (Ring 3 and 4) for home-based social and recreational trips. The trips were estimated only for zones with a dormitory population of 50 or more.

Trip Attractions

Although the trip attraction rates developed from the 1991 Household Travel Survey covering the entire modeled area, they were not used in rings Zero and One. Instead different, more refined procedures were used in those two innermost rings, as described below.

A set of linear additive equations was developed for home-based trip attractions and non-home-based trip productions and attractions. The average values of the trip rates are shown in Table 6. These equations were used beyond Ring One of the modeled area.

In the inner part of the modeled area, home-based trip attractions and non-home-based productions and attractions were generated with a different method. This is made possible by the fact that there is more and better information for this area than for the rest of the modeled area. First, in this area, the 1991 Household Travel Survey was designed to yield a higher sampling rate than elsewhere, so the data are richer and more stable. Second, as described earlier, land use data were collected for this

TABLE F-6
Average Motorized Trip Attraction Rates

Trip Purpose	Retail Employment	Service/Fire/ Gvt Employment	Other Employment	Households
HB work attractions	1.40	1.40	1.12	----
HB shop & PB attractions	4.68	1.17	----	0.20
HB S & R attractions	0.65	0.65	----	0.41
HB school attractions	0.13	0.13	----	0.35
Non-HB prod. or attr.	4.49	1.13	0.38	0.59

study in rings Zero and One, and these data can be used as independent variables in the attraction model estimation process. In addition to the Household Travel Survey and the land use data, the other data sources for this effort were: the 1991 External Cordon Survey, the 1990 U.S. Census and the 1991 CTPS Site-level employment database.

All these data were aggregated into about twenty sub-areas, each representing a data point for multiple regression analysis. The regression analysis was done using attractions plus non-home-based productions and attractions as dependent variables. Independent variables included number of households, employment by type and land use by type.

In this approach, trip ends by trip purpose were not estimated directly, as is usually done. Instead, trip ends were first estimated on the basis of the "activity" at the trip end. For example, consider a store where a Household Travel Survey respondent might engage in the activity "shop". There are six types of trips and five modeling "purposes" that could be represented by the respondent shopping at this store, as depicted in Table 7 below.

Using regression analysis, the dependent variable was all trip ends with the activity "shop" in a sub-area. Those independent variables with the best predictive power (possibly including retail floor space) were then identified and their coefficients estimated. It is only after this regression analysis was completed that the "activity" trip ends were translated into the same five model-usable trip purposes for which trips are generated in the other rings. For consistency with the other rings, non-motorized trip ends were removed from this process.

Within each sub-area, the portion of trip ends for an activity that were allocated to each modeling "purpose" were measured directly from the Household Travel Survey. This sub-area allocation among the various purposes is assumed to be uniform across each individual traffic zone in a sub-area, and this allocation is assumed to hold in 2025 as well. For example, if in the 1991 Household Travel Survey, 80 percent of the trips in the Financial District to "Eat Out" were non-home-based, it is assumed that for every zone in the Financial District, this portion will be 80 percent, both now and in the year 2025. Combining the non-home-based portions of trips estimated by the various activities resulted in the required non-home base production and attraction totals.

External Trips

External trips are those that have at least one trip end outside of the modeled area. There are

TABLE F-7
Example Relating Activity Definition to Model-usable Purpose

Nature of Trip at Activity "Shop"	Modeling "Purpose" of Trip End*
From Home to Shop	Home-based Shop Attraction
From Work to Shop	Non-home-based Work Attraction
From Other to Shop	Non-home-based Other Attraction
From Shop to Home	Home-based Shop Attraction
From Shop to Work	Non-home-based Work Production
From Shop to Other	Non-home-based Other Production

*The non-home-based categories shown here are intermediate categories. The "work" and "other" non-home-based trips are later collapsed into just "non-home-based", one of the five purposes for which trips are generated in the other rings.

three kinds of external trips. External-Internal trips are produced outside the area and attracted within it. Internal-External trips are produced within the modeled area and attracted to a point outside it. External-External trips, also called through-trips, begin and end outside the modeled area, but pass through it.

The external trip ends at each external station and for each internal zone are based on the 1991 external travel survey and traffic counts at each station. The external trip ends are divided into external-internal/internal-external trip ends and through trip ends, and the former are further divided by type of trip end (trip productions and trip attractions) and by trip purpose (the same five trip purposes used for the internal trip ends). Finally, the external-internal/internal-external trip productions and attractions by trip purpose are combined with the internal-internal trip ends. The split of trip ends into internal-external trips and internal-internal person trips for the trip distribution model determines each internal zone later.

External commercial vehicle trips were not developed separately, in order to simplify the modeling process. Rather, they are included in these external person trip productions and attractions.

Trip Distribution

Trip distribution was conducted for two categories of trips: External-Internal person trips and Internal-Internal person trips. In the past, trip distribution was done using standard aggregate-level gravity models. However in the current study, advanced matrix balancing procedures are used in distributing the trips. This procedure relies on the implementation of a three-dimensional trip balancing strategy, as provided by the EMME/2 transportation planning software. The three-dimensional trip balancing consists of the distribution of production and attraction vectors, which constitute the first and second dimension respectively, subject to a third constraint on the distributed trips pre-defined by the modeler. The third dimension is a combination of the scaled composite impedance and the total number of trips between districts. The data obtained from the 1990 Home Interview Survey was used to develop the third dimension constraint. The actual mechanics of the trip distribution procedure is highly mathematical and beyond the scope of this report and hence been omitted. Trip distribution was performed for two time periods: peak period (AM and PM) and off-peak period and four trip purposes namely, home-based work, home-based school, home-based other, and non-home-based.

Mode Choice

Mode choice models were recently developed using the 1991 Household Travel Survey data, travel impedances obtained from the networks, 1990 U.S. Census data and other data sources. There were not enough survey records for each chosen mode to estimate separate model parameters for home-based shopping/personal business and home-based social/recreational trips. Therefore, these two purposes were combined into one, and four mode choice models were developed.

Mode choice model coefficients are shown in Tables 8 through 11 below. Variables are discussed after the tables. The four models differ from one another in structure, modes represented and variables included. These differences result from both differences in initial hypotheses and in what the data were ultimately able to support in a statistically valid fashion.

The modal constants shown in the tables vary by ring of attraction as a result of the calibration process. The home-based work model has five modes: walk-access transit, drive-access transit, drive alone, two persons per vehicle and three-or-more persons per vehicle. Walk-access and drive-access transit is nested.

The home-based shopping, personal business, social and recreational model shown below has

TABLE F-8
Mode Choice Coefficients – Home-based Work

Variable	Transit Nest	Walk-access Transit	Drive-access Transit	Drive Alone	Shared Ride 2	Shared Ride 3+
Tree Coeff.	0.8137	–	–	–	–	–
In-vehicle Time	–	-.04792	-0.0479	-0.0705	-0.0705	-0.0705
Out-of-Vehicle Time	–	-.06415	-0.0710	–	–	–
Terminal Time	–	–	–	-0.3799	-0.3799	-0.3799
Fare	–	-0.4158	-0.4158	–	–	–
Auto Cost	–	–	–	-0.3623	-0.3623	-0.3623
Household Size	–	–	–	–	0.0813	0.1810
Vehicles/Person	–	–	0.6614	–	–	–
Population Density	–	0.0333	–	–	–	–
Constants						
Boston CBD	-4.4597	–	-0.8936	–	-0.2119	-2.6028
Rest of Ring 0 and 1	-5.7470	–	-4.0054	–	-0.7106	-2.3031
Rings 2,3, and 4	-7.9294	–	-6.2659	–	-1.1297	-2.9957

only four modes. There is just one shared-ride mode instead of two. As with the home-based work model, walk-access transit and drive-access transit is nested.

As shown in Table 10, the home-based school model has only three modes. There is only one transit mode, unlike in the preceding two models.

TABLE F-9
Mode Choice Coefficients – Home-based Shopping, Personal Business, Social and Recreational

Variable	Transit Nest	Walk-access Transit	Drive-access Transit	Drive Alone	Shared Ride 2+
Tree Coeff.	0.5578	–	–	–	–
In-vehicle Time	–	-0.0141	-0.0141	-0.0533	-0.0533
Out-of-Vehicle Time	–	-0.0448	-0.0448	–	–
Terminal Time	–	–	–	-0.2062	-0.2062
Drive-access Time	–	–	-0.1380	–	–
Fare	–	-0.4128	-0.4128	–	–
Auto Cost	–	–	–	-0.3930	-0.3930
Household Size	–	–	–	–	0.2379
Vehicles/Person	–	–	1.6460	–	–
Population Density	–	0.0386	–	–	–
Constants					
Boston CBD	-3.0827	–	-2.2115	–	0.1728
Rest of Ring 0 and 1	-4.4888	–	-4.1662	–	-0.0178
Rings 2,3, and 4	-6.2226	–	-10.3837	–	-0.4096

TABLE F-10
Mode Choice Coefficients – Home-based School

Variable	Transit	Drive Alone	Shared Ride 2+
In-vehicle Time	-0.0250	-0.0909	-0.0909
Out-of-Vehicle Time	-0.0397	–	–
Terminal Time		-0.2491	-0.2491
Drive-access Time	-0.0996	–	–
Fare	-0.2106	–	–
Auto Cost	–	-0.5314	-0.5314
Vehicles/Person	–	1.5660	–
Population Density	0.0199	–	–
Constants			
Rings 0 and 1	1.2599	–	3.4206
Rings 2,3, and 4	0.2196	–	4.0557

The non-home-based model shown in Table 11 consists of four modes. Unlike the first two models, though, walk-access transit and drive-access transit is not nested here.

The mode choice model variables are defined as follows.

Tree coefficient: This represents the combined utilities of the drive-access and walk-access components of the transit nest.

In-vehicle time: For the shared-ride modes, in-vehicle and out-of-vehicle time are functions of drive alone time, as estimated by a procedure developed at CTPS in a previous study.

Out-of-vehicle time: Includes all walk and wait time and drive-access time, unless the last is specified separately.

Drive-access time: Time, by automobile, to drive from a trip origin to a transit station.

TABLE F-11
Mode Choice Coefficients – Non-Home-Based

Variable	Walk-access Transit	Drive-access Transit	Drive Alone	Shared Ride 2+
In-vehicle Time	-0.0144	-0.0144	-0.0496	-0.0496
Out-of-Vehicle Time	-0.0172	-0.0172	–	–
Terminal Time	–	–	-0.0647	-0.0647
Drive-access Time	–	-0.0286	–	–
Fare	-0.2671	-0.2671	–	–
Auto Cost	–	–	-0.2303	-0.2303
% Transit origin/destination	0.0514	0.0514	–	–
Work Dummy	–	–	0.9704	–
Constants				
Boston CBD	-0.1309	-1.3651	–	0.5462
Rest of Ring 0 and 1	-0.9579	-3.2618	–	0.3641
Rings 2,3, and 4	-3.2666	-3.6198	–	0.0687

Terminal time: The time needed to park and unpark a vehicle. That is, it is the time spent getting in a vehicle at the production end and entering the modeled highway network and the time spent leaving the modeled network and parking the vehicle at the attraction end of the trip. These times are as high as five minutes in the Boston CBD and as low as one minute in suburban areas. They are assumed to remain constant in the future.

Fare: Transit fare, in dollars, including one-half of any park-and-ride charges (because fare per one-way trip is needed). The adult cash fare is used because that is what is coded into the transit network. Fares are assumed to remain constant over time.

Auto cost: Auto operating cost in dollars, computed using 9.8 cents per mile ($1991) and toll costs, if any. Also, one-half any applicable parking costs (because costs per one-way trip are needed). These parking costs are based on the 1991 Household Travel Survey, and are computed from reported district average costs paid by auto mode choosers. They are assumed to remain constant over time. For shared ride modes, total costs are divided by the appropriate auto occupancy.

Household size: Persons per household. For 2025, population and household forecasts are provided by MAPC.

Vehicles/person: Total household vehicles per person in the household. Vehicles are forecast for 2025 using the vehicle availability model described earlier.

Population density: Total population per acre.

Percent transit origins/destinations: The transit share of work trip ends in the TAZ, as computed by the home-based work mode choice model.

Work dummy: Equal to one, if the trip is work-related. Zero otherwise.

Trip Assignment and Associated Computations

Trip assignment is the final step in the four-step travel modeling process. Trips by mode created in the mode choice step are assigned to their respective networks in order to estimate traffic volumes and transit ridership on specific transportation services. In addition, systemwide statistics such as vehicle-miles traveled, total amount of pollutants emitted in the air etc., are computed in this step.

Pre-assignment Computations

After mode choice, but prior to trip assignment, daily highway person trips were transformed into vehicle trips and combined with other types of vehicle trips. Internal and external-internal auto person trips that are output from the mode choice model were transformed into vehicle trips using the occupancy rates shown below.

The rates for external trips were derived from the 1991 External Cordon Survey, while those for internal trips were derived some years ago at CTPS.

TABLE F-12
Vehicle Occupancy Rates

Trip Purpose	Internal Trips Boston CBD	Attracted to: Other	External Trips
Home-based work	1.20	1.10	1.18
Home-based other	1.70	1.60	1.65
Non-home-based	1.30	1.20	1.31

TABLE F-13
Time Periods for Trip Assignment

Time Period	Highway Vehicle Trips	Transit Person Trips
AM Peak Period	6:00 am – 9:00 am	6:30 am – 9:30 am
Midday	9:00 am – 3:00 pm	9:30 am – 3:30 pm
PM Peak Period	3:00 pm – 6:00 pm	3:30 pm – 6:30 pm
Early/Evening/Night	6:00 pm – midnight	6:30 pm – midnight

Time of Day Considerations

In the current version of the travel model set, the mode choice and transit assignment are conducted for four time periods: AM peak period, Midday, PM peak period, and Nighttime. The trip generation model however, is based on daily trips. The trip distribution model considers two time periods, peak and off-peak periods.

The highway and transit networks are built separately for each time period. Table 13 shows the time intervals associated with each time period. The highway vehicle trips created by the mode choice model were converted from production/attraction format to an origin/destination format prior to network assignment. Transit person trips were also transformed from production/attraction format to origin/destination format, for each time period and assigned to the transit network.

The factors used in dividing the highway person trips into different time periods were obtained from the 1991 Household Travel Survey. The final trip tables created for each time period correspond roughly with observed levels of congestion on the highway system. The results of the four assignments were summed to obtain daily (AWDT) results.

The temporal factors used in creating the transit trip tables were based on the 1994 MBTA boarding counts. Prior to trip assignment, other types of trips are added to the highway vehicle trips that result from the trip generation, distribution and mode choice steps described above. These other types of trips are commercial vehicle trips, taxi trips, trips to/from Logan Airport and through trips.

Trip Assignment

The final travel model step is trip assignment in which highway vehicle trips and transit person trips are assigned to their respective networks.

Highway

Highway vehicle trips were assigned to the highway network using EMME/2's multiclass assignment procedure. This procedure is a true

TABLE F-14
Highway Assignment Characteristics

Assignment Period	Number of Hours	Capacity Hours	CONFAC	Exponent of BPR Curve
24-Hour	24	10.00	0.100	4
AM Peak Period	3	2.67	0.375	6
Midday	6	5.00	0.200	4
PM Peak Period	3	2.67	0.375	6
Early/Evening/Night	12	5.00	0.200	4

equilibrium assignment in which several classes of users perceive or use the network differently. Each user class has access to a subnetwork of the auto network. Therefore, auto trips, HOV trips and truck trips can all be assigned simultaneously to their respective routes. The assignment is restrained by link capacity according to an equilibrium-seeking capacity-restraint method. The CONFAC parameters and the exponents of the BPR curve used for assignments are as shown in Table 14.

Highway assignment speed and volume results were saved and input to a post-processing routine that computes regional ozone precursor emissions using MOBILE emissions rates. The routine processes each link in the highway network. The routine finds the VOC and NOX emissions rates corresponding to a link's modeled speed and then applies those rates to that link's vehicle-miles of travel. This yields emissions per link, and these are then summed over all links to obtain regional emissions.

Transit

Transit person trips are assigned to the transit network using multi-path assignment procedure embedded in the EMME/2 software. In the conduct of the PMT forecasting, these assignments were examined to ensure that there are no serious distortions or lumpiness in passenger boardings. A plethora of information – linked transit trips, ridership by line and station, peak loads, transfer volumes, modal splits, etc., -- were generated from the transit assignments. These statistics are discussed in greater detail under 'Model Application and Results'.

Model Calibration

Calibration of Trip Distribution and Mode Choice

Model calibration was performed in the last three steps of the modeling process. Trip distribution model calibration was performed by balancing the base year trip productions and attractions subject to a third constraint which was a combination of scaled composite impedances (observed) and total distributed trips (observed). The multipliers associated with the

TABLE F-15
Results of the Mode Choice Model Calibration for Peak Period

		Peak Survey	Model
	Transit Nest	11.75%	12.82%
Home Based Work	Walk Access	8.25%	9.67%
	Drive Access	3.50%	3.15%
	Drive Alone	67.50%	67.41%
	Shared Ride (2)	12.15%	12.09%
	Shared Ride (3+)	3.25%	3.17%
	Walk	5.35%	4.51%
	TOTAL	100.00%	100.00%
	Transit Nest	3.48%	3.60%
Home Based Other	Walk Access	3.11%	3.20%
	Drive Access	0.37%	0.39%
	Drive Alone	48.32%	40.80%
	Shared Ride (2)	35.28%	39.53%
	Walk	12.91%	16.08%
	TOTAL	100.00%	100.00%
	Motor Nest	68.40%	61.79%
Home Based School	Walk Access	9.10%	8.18%
	Drive Access	1.20%	2.28%
	Drive Alone	12.45%	9.56%
	Shared Ride (2)	45.70%	41.76%
	Walk	31.60%	38.21%
	TOTAL	100.00%	100.00%
Non Home Based	Walk Access	5.37%	5.08%
	Drive Access	1.23%	0.68%
	Drive Alone	59.13%	52.39%
	Shared Ride (2)	22.59%	25.18%
	Walk	11.68%	16.67%
	TOTAL	100.00%	100.00%

third dimension constraint are used to estimate what is called “gamma function”. The purpose of the gamma function is to make sure that the distributed trips from matrix balancing closely match the observed distribution obtained from travel surveys. For each zonal interchange, the gamma function is used to estimate the number of trips that fall into a certain category of composite impedance. Separate gamma functions were developed for each trip purpose.

After the calibration of trip distribution was completed, the mode choice models were run, and the modal bias coefficients in them were adjusted until estimated mode shares by ring matched observed shares. Table 15 shows the final transit trips by trip purpose and mode of access that resulted from the model calibration.

Calibration of Assignment

The trips tables obtained from the mode choice models were assigned to the appropriate highway and transit networks. Highway calibration was limited to ensuring the assigned highway volumes on major freeways and expressways matched the observed volumes within 15 percent. On the transit side, a significant effort was expended in the model calibration to ensure the assigned transit trips matched the observed ridership within 5 to 10 percent. Adjusting the network attributes such as walk and drive access links, transfer links and access connections were performed for calibration.

Air Quality Analysis

The air quality impacts of alternative transportation scenarios can be analyzed using the standard traffic forecasting models. Our models estimate future traffic volumes, average highway speeds, vehicle miles and vehicle hours traveled within the transportation network at a highly disaggregate level. Since the amount of air pollution emitted by the highway traffic depends on the prevailing highway speeds and vehicle miles traveled on the network, it is now possible to estimate the air quality impacts with reasonable accuracy.

Typically, we estimate three major pollutants emitted by the transportation sector: Carbon Monoxide (CO), Volatile Organic Compounds (VOC) and Nitrous Oxides (NOx). The model uses Mobile 5A emission factors to calculate these three pollutants on a link-by-link basis. Carbon Dioxide wasn’t a component of MOBILE 5B model so this was calculated off model for both autos and transit vehicles.

There are other components contributing to traffic pollution which can not be handled directly within the model. These are:

1. The pollutants emitted by the Diesel Locomotives of the Commuter rail system.
2. The pollutants emitted by the MBTA bus system.
3. The automobile pollution resulting from park and ride trips.

The pollutants from the above mentioned categories can be estimated outside of the model. The following paragraphs describe the general off-model procedure that was used to handle these categories.

Estimation Procedure for Non-Modelable Pollutants

Commuter Rail Diesel Locomotives

Using extensive data supplied by the MBTA and the diesel locomotive manufacturers, the EPA has developed pollutant emission factors that express the amount of pollutants emitted as a function of daily train-miles run. Our basic approach involved the following steps.

1. Obtain the current train-miles run by the MBTA per day.
2. Based on the MBTA’s future service plan, estimate the number of train-miles to be run per day for each forecast year on all the existing rail lines as well as on all future

extensions and new services such as the Old Colony lines.

3. Using the emission factors developed by the EPA, and the number of train-miles calculated from the previous step, estimate the amount of pollutants emitted by the commuter rail system for each horizon year.

The emission factors developed by the EPA are based on the total diesel fuel consumption by the entire MBTA's commuter rail system. Therefore, the pollutants emitted during the long idling periods have also been figured into the calculations.

MBTA'S Diesel & CNG Buses

The bus emissions were calculated in the same way as the commuter trains but with an emission factor specific to the bus fuel type. The bus emission factors for each forecast year were calculated from the MBTA's future plans regarding the vehicle procurement rate, vehicle replacement rate and the fleet composition by vehicle age.

ANALYSIS

This section will describe how the calibrated model discussed above was applied to forecast transit ridership and estimate air pollution impacts of the PMT analysis.

Analysis by Model

In any alternative analysis such as this, it is customary to model a base case alternative generally known as the No-build and compare all the build alternatives to it. The No-build is designed to serve as a point of reference for the environmental and alternative analysis. It usually consists of those highway and transit projects that are nearly certain to be completed by the forecast year. The build alternatives assume the No-build conditions and add to it the proposed transit or highway improvements.

The No-build scenario has all of the projects that were in the 2000 Transportation Plan. If a transit project was in the Plan and in the PMT, it was not included in the No-build scenario.

The build scenarios involved updating the transit network for each mode considered in the PMT. This involved adding new lines, new stations, improved frequencies, run-times, park-and-ride lots, and adjusting capacities on the lines to reflect the utilization of that service improvement, whether it be expansion or enhancement. The result was a summary of new trips using transit switching generally from the automobile to transit. Diverted trips represent those trips that were transit to begin with but switched from another transit mode to the new / improved service.

Analysis Off-Model

The Regional Model was used to analyze the majority of the projects in the PMT but when it wasn't other methods were employed. Some examples of when the model wasn't employed include commuter rail projects that extended outside the study area into areas in like Cape Cod, Western Massachusetts, New Hampshire, or Rhode Island. In order to examine these types of projects other means of analysis were employed like sketch planning, spreadsheet based models, and reports by consultants were used to derive the levels of utilization that these projects would have. Each project was examined on a case by case basis to determine what method would prove the most suitable for it. In order to allow for comparison between model and off-model projects, similar demographic and background transportation services were used in both analyses.